Russian Business Groups: Ownership and Control, Performance and Market Structure

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Abstract

The focus of this thesis is the impact of business groups on company performance and the evolution of market structure in Russia. Business groups' control of a large share of industry is a distinguishing and controversial characteristic of the Russian transition. This thesis contributes to the quantitative analysis of the economic impact of Russian business groups.

The first chapter analyses the gap between control and ownership in Russian companies. We find a significant difference in the size and structure of the total gap compared to the component resulting from the use of pyramidal ownership structures. Our results suggest that standard estimators that account only for the pyramidal effect might be biased by the presence of endogeneity and measurement error problems. The second chapter examines the impact of business groups on company performance. In a majority of specifications, including the use of instrumental variables, we find that business groups have a consistently insignificant impact on the productivity growth of companies they control. This conclusion contrasts with previous studies of the impact of Russian business groups on firm performance. The third chapter tests the applicability of Sutton's sunk costs theory of market concentration to Russian industries. Our results are consistent with Sutton's theoretical predictions that concentration in industries with endogenous sunk costs does not decrease with market size.

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Chapter 1: Introduction

In many former socialist economies market transformation has created a specific class of large private owners with the characteristics of business groups. In Russia, the history of business group formation, their role in the economy and the politics of the country has been very controversial. The first major attempt to quantify the economic role of the Russian business groups, also often referred to as oligarchs, was made by the World Bank study in 2003. It resulted in a unique dataset that provided the opportunity to analyze quantitatively the ownership structure of business groups, their effect on firms' performance and the evolution of the industry structure. In this thesis we combine two datasets, the World Bank ownership dataset and the Russian industrial registry, to study three different aspects of the phenomenon of business groups: 1) the control and ownership concentration and leverage mechanisms within companies; 2) the business group effect on company productivity; 3) and market structure evolution.

Early research on the economic significance of separation between ownership and control, e.g., Berle and Means (1932), characterized the modern firm as having a highly dispersed ownership structure. This characterization was questioned by the empirical literature in the 80s and 90s which demonstrated that concentrated ownership is widespread. This finding shifted academic interest from the analysis of manager-owner agent problems to the study of the consequences of control leverage exercised by major shareholders.

In the empirical literature, the control-ownership gap is predominantly measured as a leverage resulting from pyramidal ownership structures. However, in practice controlling stakeholders use additional methods that often escape precise measurement, e.g. affiliated management, control over supply and delivery networks, control over debt arrears. This chapter fills the gap in the literature by estimating the total control-ownership gap and decomposing it into two effects: pyramidal and informal.

Theoretical models predict a negative impact from the control-ownership gap on the performance of companies. Empirical surveys on this topic have lead to contradictory conclusions. This might be explained by an omission of the non-pyramidal component of the control-ownership gap in these estimations.

The main contribution of chapter 2 is a unique quantitative analysis of the control-ownership gap based on a large sample of Russian companies. This unique dataset enables us to decompose the total control-ownership gap into a pyramidal and an informal component. Thus we are in a position to assess the validity of the widely assumed hypothesis that the pyramidal component can be used as a proxy variable for measuring the total control-ownership gap. Our results indicate that these two components have significantly different effects, and that the usually omitted non-pyramidal element is correlated with some of the common explanatory variables. This finding suggests that the use of a pyramidal only control-ownership gap may result in biased estimates of parameters.

The second chapter also details the results of estimations of the ownership and control structure in large Russian companies. Business groups appear to have the largest control leverage over ownership level, and exercise it mainly via informal channels. Foreign owners often have the smallest difference between control and ownership. We find that on average less than half of the control ownership gap is due to the commonly assumed factor, pyramidal structures.

In the next chapter we use information on the ownership and control to identify the ultimate major owners and study their impact on the performance of the companies. We focus our attention on a particular group of private owners - large business groups. Although business groups in transition economies draw significant interest of economists, the number of works with systematic quantitative analysis remains limited. The third chapter aims to fill this gap.

Both theoretical and empirical literature on business groups are divided regarding their impact on firms' productivity. Many studies of East Asian business groups (often after the 1998 crisis) find evidence of a negative business group effect due to conglomerate inefficiencies. Studies of other emerging economies, however, show that business groups can have a positive effect on companies' performance when they take on the role of failed or underdeveloped institutions in the country.

A noteworthy work by Guriev and Rachinsky (2005) showed that business groups in Russia have positive effect on companies' productivity growth. To make our results comparable to previous studies we measure business group effect by introducing dummy

variables in total productivity function; we expand the analysis by including larger time period and using different estimation methods that address existing problems. In particular, we use instrumental variables to address possible endogeneity problems and long difference estimator to reduce the impact of measurement errors.

Business groups' impact on the company productivity growth appeared to be consistently insignificant in the majority of specifications. This is in contrast with previous findings based on a single cross-section model specification.

In chapter four we shift our focus to the market structure evolution and use our knowledge of the ownership structures to calculate the concentration ratios that take into account hidden horizontal integration. Transition economies provide a unique research material, almost natural experiment, for testing industrial organization theories: at the start of the transition in Russia, individual plants were privatized as individual firms, and this was followed by the endogenous formation of conglomerates and multi-plant firms. In 1991 John Sutton created a theory of market structure formation. He divided industries into two types based on the opportunities for the firm strategic behaviour. Markets with homogeneous products are characterised by exogenous sunk costs, and sufficient expansion of the market size will bring concentration levels down. Markets with heterogeneous products have high advertising and R&D expenditures, i.e. endogenous sunk costs, and market size growth will not necessarily decrease the concentration levels.

Despite the applicability of Sutton's theory, the number of empirical studies devoted to its verification remains limited. Most of these works are focused on the specialized markets in developed economies and only a few studies have tested its validity in transition economies. The forth chapter in this thesis aims to assess the validity of Sutton's theory and address several related estimation problems.

Our results confirm Sutton's theoretical predictions. Before the transition in 1991 both types of industries had a lower bound of market concentration negatively dependent on the market size. In 2003 however, only industries with exogenous sunk costs demonstrate this regularity. The lower bound of market concentration for industries with endogenous sunk costs is independent of the market size growth.

Chapter 2: Explaining the Control-Ownership Gap in Russian Companies

2.1 Motivation

Berle and Means (1932) pioneered the research on separation of ownership and control in modern corporations and drew public attention to the resulting shortfalls in competences and responsibility that could affect company performance. They were the first to analyze the consequences of the fact that the ownership of many large American corporations is widely dispersed, while their control is concentrated in the hands of a small number of managers. Their findings shaped the image of the modern firm for decades ahead and motivated extensive research on "managerial" problems, i.e. agency problems. The works of Jensen and Meckling (1976), Fama and Jensen (1983a, b) are among the main body of research to examine the implications of the separation of decision and risk bearing functions.

However, the relevance of the Berle-Means corporate model was questioned by empirical studies in the late 80s and 90s (Demsetz and Lehn, 1985; Shleifer and Vishny, 1986; etc.). In an article on the corporate ownership structures in 27 countries around the world, La Porta *et al*. (1999) showed that widely dispersed ownership is not that prevalent and a substantial number of large corporations have major controlling owners. Their findings have switched the academic focus to the control leverage over cash-flow rights exercised by dominant stakeholders and on the expropriation of minority shareholders rights.

The problem of control leverage by the main shareholder is different from the classic principal agent problem between managers and shareholders in several ways. First, there is less external control by shareholders and a higher probability of entrenchment. Second, major shareholders having ultimate control rights and a biased target function may take suboptimal economic decisions that do not maximize companies' value. Third, in contrast with the owner-manager agency problem there is no clear consensus in the literature on the economic consequences of the control ownership gap leveraged by major stakeholders.

Theory states that a high concentration of ownership is beneficial due to enhanced monitoring of management by the main stakeholder. Nevertheless the separation of

control rights from cash-flow rights biases the incentives of decision makers and leads to suboptimal investment levels, excessive risk taking and looting. Control leverage may be exercised by the largest stakeholder via three main mechanisms: pyramidal structures, double class shares and informal control channels.

Almeida and Wolfenzon (2006a) specifically model the incentive mechanisms behind the formation of pyramidal schemes. They postulate that an owner of a company, A, can artificially increase his level of control by increasing the number of intermediary companies B, given that the stake of each new company in the ownership chain is less than 100%. Pyramiding remains the most widespread mechanism of separating control from cash-flow rights (La Porta, 1999). Double-class shares are not widely employed many countries and are accounted for in several studies. In practice, controlling stakeholders exploit additional methods such as affiliated management, appointment of board directors, control over debt arrears, control over distribution and supply networks, influence on investment inflows, ownership of brand names. We will refer to the above practices as the second type of control enhancing mechanisms, in opposition to the first type, the more commonly used pyramidal effect. It is worth mentioning that the non-pyramidal control-ownership gap is largely ignored in the literature.

In this chapter we estimate the total control ownership gap and decompose it into two components: pyramidal and informal control. We apply this classification to a unique dataset containing both ownership data and expert assessments of the total control level. We assess the validity of the narrow control-ownership gap definition as a proxy of the total control ownership gap. The results obtained are specific to Russian companies and caution should be exercised regarding their wider interpretation. However, they provide a clear indication that this narrow definition can be misleading and that further research on measuring the full control-ownership leverage and re-assessing its effects is needed. By measuring and decomposing the control ownership gap, this chapter also provides a starting base for explaining the causes and effects of ownership design in Russia.

A detailed summary of theoretical research on the determinants of ownership structure can be found in Lim and Kim (2005). Lim and Kim also describe agency problems arising from the separation of ownership and control. While the theory is conclusive on the negative impact of control ownership gap on the valuation of companies, empirical evidence is not. A large part of the empirical literature indeed finds that high ownership

concentration has a positive influence on the firm's performance while large leverage of control over cash-flow rights has a negative influence (Claessens *et al*., 2002; Du, Dai, 2005 among others). In addition, a number of articles show that the separation of ownership and control has no impact on the valuation of companies (Carvalhal *et al*., 2000; Ben-Amar, Andre, 2006; Holmen, Knopf, 2004).

The majority of the literature on the control-ownership gap estimates control according to its narrow definition to measure the effects of pyramidal schemes (Claessens *et al*., 2002) and the use of non-voting shares (Ben-Amar, Andre, 2006; Holmen, Knopf, 2004). The lack of distinction between the two effects remains a major weakness of these studies and is partly due to the difficulty in measuring the control variable. The information on the total control gap, including informal mechanisms, would require estimates based on experts judgment and is normally not available. However, qualitative evidence based on case studies indicates that the total control ownership gap can significantly exceed its narrow definition. For instance, in post-privatization Russia, controlling stakeholders often hold top management positions in the company. The practice of taking the control of the company by acquiring its debt and threatening to bankrupt the enterprise was also widespread. The possibility that this selective evidence has wider confirmation has an important implication. It would mean that the narrowly defined control-ownership gap should pass the test of being an appropriate proxy variable for the total control-ownership gap. This includes two questions to be additionally studied. What is the importance of the informal control gap in the total control ownership ratio? Does it have a distribution of white noise type, not correlated with some of the explanatory variables?

This chapter aims at improving our understanding of the control ownership gap structure and the difficulties associated with its measurement. To that end a quantitative analysis of the control-ownership gap is applied to a large sample of Russian companies. In contrast to the 'traditional' ownership-control gap as defined by Berle and Means, where the gap is between numerous uninformed shareholders and powerful managers, and which has been thoroughly analyzed in the agency models, to the best of our knowledge no similar analysis has been performed so far on the control-ownership gap between the controlling stakeholder and minority shareholders.

Empirical testing of the effects of ownership concentration and control leverage requires specific datasets that are not easily available. For this reason quantitative studies of the

ownership and control concentration are limited to a number of countries (East Asia, India, Chile, Sweden, Canada) for which the ownership datasets exist. Ownership, usually understood as cash-flow rights, can be directly quantified given that the individual stakes in the ownership chain are known. Quantifying the control variable, however, is more complex as the concept behind it is wider and not directly measurable. Besides, the information available is usually scarce.

A high correlation between the total control effect and the pyramidal effect would justify the use of the latter in estimating the impact of full control ownership gap on the performance or valuation of companies. However, in the worst case scenario when informal control accounts for a large part of the total gap, and is weakly correlated with the pyramidal effect, and is not independent from the explanatory variables, the significance of the obtained estimations can be questioned. Standard assumptions for obtaining the unbiased and consistent estimators would be undermined by the presence of the measurement errors and endogeneity problem. Consequently, studies of the countries where informal control plays a larger role than the pyramidal schemes and/or is not correlated with the latter, the use of the narrow control definition for estimating valuation effect could lead to the rejection of causality even if it exists for the total control-ownership gap.

Apart from the potential implications for the cross country research on control and performance interrelationship, this chapter contributes to a better understanding of the ownership and control architecture of the Russian corporate sector. The majority of the empirical studies on the corporate governance in Russia focus on the ownership concentration. While references to the existence and potential importance of control ownership gap are frequent in the literature (Guriev *et al*., 2005) there were no quantitative estimates for large samples.

The standard corporate governance literature pays significant attention to the differences in the impact of various types of owners on company performance. State-owned companies usually are suspected of underperforming whereas foreign-owned firms are generally praised for their better corporate governance practices. In this chapter we look at the effect institutional types of owners have on the total control ownership gap as well as their preferences for the mechanism used to exercise it. We also include the size of

companies in our analysis, as some studies found it to have an impact on governance patterns and management efficiency.

2.2 Literature Review

Economic analysis of the ownership structure of modern firms originates form Berle and Means (1932). For the first time they analyzed the impact of the separation between control and property rights in public corporations. The authors outlined that in companies with widely dispersed ownership structures, the key decisions on capital raising and profit redistribution are commonly delegated to management. This work inspired a large number of studies on the incentives and efficiency biases coming from the separation of control and ownership, which resulted in the comprehensive set of "agency problem" models developed in 1970s.

Agency theory states that a higher ownership concentration can be beneficial for the performance of companies due to the improved incentives and possibilities for the main shareholder to monitor management. Bolton and Thadden (1998) model the trade-off between liquidity benefits of dispersed ownership versus improved management control provided by concentrated ownership. At the same time diversion of actual control level from the cash-flow claims can reverse this result. Bebchuk *et al.* (1999) warns that corporate structures with large control ownership gaps combine the incentive problems of both the dispersed ownership and controlled structures with a direct majority block-holder. The distorted decision mechanism leads to suboptimal firm size and inefficient choice of projects. The model predicts positive effect of high ownership concentration. However, when the gap exceeds a certain limit the incentives for asset-stripping and cash flow extraction might outweigh the costs and risks associated with these activities. In addition, the control-ownership ratio influences the risk behaviour of the investors and a high enough gap might motivate them to exceed the optimal risk levels. The size of agency costs is sharply increasing in reverse relationship to the cash-flow rights of the controlling shareholder. The authors also argue that the related agency costs are higher than of highly leveraged firms. On the basis of this theory we expect the companies with a high control-ownership gap to have worse performance indicators than the companies with the same level of ownership concentration but smaller differences between control and ownership.

The theory addressing the ownership structure of a single firm is conclusive that control-ownership gap diminishes the value of a firm. However, this view may neglect an important aspect of the control-ownership leverage, namely that the underlining

incentives behind its formation is often the ownership of multiple companies by conglomerates. Almeida and Wolfenzon (2006a) model this type of investors' behavior and their use of the control-ownership gap as a mechanism for the creation of conglomerates and business groups. They argue that pyramidal schemes are often used by conglomerates in different countries to expand the assets under their control with the minimal capital costs. Although using pyramidal structures biases the incentives and may lead to suboptimal investment and risk decisions by the controlling stakeholders, it can be compensated by the benefits associated with being part of the business group. There is a large amount of the related literature on business groups and their impact on company performance (literature review of these can be found in chapter 3). While literature results are far from being conclusive in their current state, they provide the explanation that investors are sometimes willing to take the risks associated with pyramidal schemes in order to gain from business groups' spillovers. An example of such spillovers could be lower cost bank credits available to business groups (Lim and Kim, 2005).

While the theory rationalizes the negative impact of the control-ownership gap on the valuation and performance of companies it is important to acknowledge the existence of the factors, like benefits connected with the business group ownership that often are not accounted for by the standard models. That might or might not be the reason why the empirical results are less conclusive than the theoretical predictions regarding the performance effect of the control-ownership gap. Table 1 contains the list of major empirical works and a brief description of their results.

A vast majority of the related literature focuses solely on studying the ownership concentration and avoids issues related to the definition and measurement of the control level. These studies often implicitly assume the control variable to be binary and to equal 100 % for the main stakeholder. In that respect the evidence on the impact of the ownership concentration on the performance of companies can be interpreted with the opposite sign for the effect control-ownership gap. If it is shown that a higher share of the cash-flow rights in the possession of the main stakeholder has a positive impact on performance, it can be inferred that control-ownership gap has a negative effect.

The literature on the control-ownership structures is concentrated on a set of countries that traditionally have higher concentration of ownership in their economies, including East Asia countries like Japan, Korea, Indonesia, Hong Kong, Malaysia, Singapore,

Taiwan, Thailand, other emerging economies like India, Chile and Brazil and few developed economies including Sweden and Canada.

A large number of articles contain evidence that supports the notion of negative impacts from the control-ownership gap on companies' valuations or positive impacts of ownership concentration on performance (Claessens *et al*., 2002; Claessens and Djankov, 1999; Du, Dai, 2005; Lemmon, Lins, 2003; Villalonga, Amit, 2006). Claessens *et al.,* (2002) disentangled incentive and entrenchment effects of the concentrated ownership for companies in several East Asian countries and found an advantageous effect of cash-flow rights share and a negative impact of control leverage. The consequent study of the East Asian corporations Du and Dai (2005) found evidence that separation of control and ownership contributes to a risky capital structure. The authors also link it to corporate governance problems during the East Asian financial crisis.

Large divergence between control level and cash-flow claims is usually associated with weak protection of minority shareholders and low-quality corporate governance. Additional research on business groups highlights their lower efficiency due to bad corporate governance and weak connection between firm performance and top management rotation (Campbell, Keys, 2002; Miwa, Ramseyer, 2003).

Recently more evidence has become available on limited or nonexistent adverse link between company performance and control leverage over the cash flow rights. These studies can be divided into two groups based on the state of development of their economies and institutions: developed or emerging.

Ben-Amar, Andre (2006) shows that in Canada a large fraction of public companies have controlling shareholders (usually families), that exercise higher control than their voting rights. However, it does not result in a lower market valuation of these companies. The authors explain that a strong institutional framework prevents market participants from perceiving higher control leverage as a danger of value expropriation from minority shareholders. Similar results were obtained by Holmen and Knopf (2004) who analyzed impact of ownership structure on the valuation of Swedish companies. The authors explain the limited evidence of minority shareholder expropriation by the fact that Sweden's extralegal institutions neutralize the risks coming from weak corporate governance. However, Bozec and Lauren (2008) found that when the main stakeholders

in Canadian companies have both incentives and opportunities to expropriate minority shareholders their firms are subject to underperformance.

A study of Brazilian companies, Carvalhal *et al*., (2000), revealed a large degree of concentration of the voting capital, and significant differences between voting and total capital held by the largest shareholders. It also concludes that pyramidal structures are widely used. No evidence was found to support any significant effect of the control ownership gap on the valuation of companies. In addition, research on the business groups that widely use pyramidal ownership structures revealed positive gains in the company performance (Luo and Chung, 2005; Khanna, Yafeh , 2007)

Many studies on the control and ownership structure contain a large descriptive component due to the specificity of the analyzed data and the importance of data collection techniques for further analysis. Information on ownership structures is not easily available and the majority of researchers face the necessity of compiling their own datasets. A description of ownership architectures in different countries is usually very enlightening, however many of these studies would benefit from more substantial analytical components. There are few studies aimed at explaining the formation of ownership and control levels (Bebchuk, 1999; Grosfeld, Hashi, 2007). The lack of literature investigating the factors defining levels of control and ownership in companies is substantial. Furthermore, the main factors that contribute to higher control-ownership leverage largely remain to be identified.

While there might be multiple reasons for the differences in the empirical findings on the control ownership gap we would like to draw the attention to the one resulting from the inappropriate treatment of the endogeneity problem and measurement error in the control variable. From the theoretical perspective, control is defined by the ability to make key decisions in the company management. Thus control level can not be measured as precise as ownership share and might be better approximated by using expert opinions on the decision making processes in the company.

As mentioned above there are three methods by which main stakeholder can enhance the control level over the cash-flow rights: dual-class shares, pyramidal structures and other less easily observable mechanisms. Most of the literature uses low boundary for the control measure: pyramidal effect in some cases supplemented by accounting for non-

voting shares. Dual class shares are not widely used in the world, with the exceptions of Canada and South Africa (Bebchuk, 1999) and thus their omission is often practical. Crossholding of shares between groups of companies provides an additional mechanism of control enhancement. However, it is the least transparent and most difficult to estimate.

Empirical evidence regarding the control-ownership gap impact is useful from the point of view of the public policy response. However, among the studies that conclude on the insignificant role of the control-ownership gap, it is necessary to identify whether the results are caused by measurement errors or by offsetting efficiencies that outweigh the negative impact predicted by agency theory. In this regard, identification of the measurement error biases in estimating control-ownership gap impact on the companies' valuation and performance is important.

Table 1: Literature overview on control ownership gap

Article	Countries	Ownership structures description	Methods to enhance control	Economic consequences
La Porta *et al*., (1999)				
Claessens *et al*., (2000)	East Asia[1]	Larger gap in family-owned and small companies, except Korea, Singapore, Taiwan. No dispersion of ownership over time	Pyramids and cross-holding	Wealth concentration and barrier to future policy reform
Claessens *et al*., (2002)	East Asia[1]			Negative impact on firm value due to entrenchment effect. Higher cash-flow rights positive effect via incentive effect
Claessens, Djankov (1999)	Czech Republic	Study of ownership concentration		Positive impact on profitability and labor productivity
Du, Dai (2005)	East Asia[1]	Data from Claessens *et al.,* (2002)		Higher market leverage, higher risks and corporate value losses
Lemmon, Lins (2003)	East Asia[1]	Large separation between cash-flow rights and control rights	Pyramidal structures	Underperformance of stock for firms with high control leverage during the crisis, not before
Lim and Kim (2005)	South Korea	Conglomerates with high family control (chaebols)	Pyramidal and nonvoting schemes	Government support and low cost bank borrowing contribute to chaebols growth and compensate minor investors. Higher ownership concentration in narrowly focused chaebols. Inverse relationship between control and debt leverage.
Carvalhal *et al*., (2000)	Brazil	A large degree of concentration of the voting capital, and reasonable difference between voting and total capital held by the largest shareholders	Pyramid structures are not most important, non-voting shares are	No effect on valuation
Ben-Amar, Andre (2006)	Canada	Large share of public companies have controlling shareholders (families) that exercise control over voting rights while holding small fraction of cash-	Dual class voting shares and stock pyramids	No negative impact on company performance

[1] Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand

		flow rights		
Holmen, Knopf (2004)	Sweden	High degree of separation of ownership from control	Pyramids, dual-class shares, cross-holdings	Limited evidence of shareholders expropriation
Demirag, Serter (2003)	Turkey	Ownership is highly concentrated with families being the dominant shareholders	Pyramids, business groups presence	
Arslan, Karan (2006)	Turkey			Effect on debt structures (maturities of the company)
Faccio, Lang. (2002)	Western[2] Europe	Widely held and family controlled firms dominate	Use of multiple class voting shares and pyramids is marginal	
Thomsen, Pedersen, (2000)	Western Europe[3]			Positive effect of ownership concentration on shareholder value, which disappears at high levels of concentration
Grosfeld, Hashi (2007)	Poland, Czech Republic	Increased concentration of ownership		In the Czech Republic, the increase in ownership concentration is less likely in poorly performing firms, while in Poland the quality of past performance does not affect investors' willingness to increase their holdings
Villalonga, Amit (2006)	US	Study of the family owned firms	Multiple share classes, pyramids, cross-holdings, or voting agreements	Family control in excess of ownership reduces shareholder value

[2] Austria, Belgium, Finland, France, Germany, Ireland, Italy, Norway, Portugal, Spain, Sweden, Switzerland, and the UK
[3] Austria, Belgium, Denmark, Finland, France, Germany, the United Kingdom, Italy, the Netherlands, Norway, Spain and Sweden

2.3 Data and Variables Description

A unique database of the largest Russian companies was assembled by the World Bank for its country economic memorandum report in 2003. This database contains detailed information on the ownership and control of the largest Russian enterprises. Researchers collected information from a wide variety of sources such as commercially available databases and websites, interviews with financial analysts and industry experts. The detailed description of the survey methodology can be found in the World Bank Report "From Transition to Development" (2004). This database enabled us to trace ownership and control links between the companies, and calculate the cumulative ownership stakes and control-ownership gaps of ultimate stakeholders.

The survey was constructed with the aim of identifying the final controlling owners of the companies in the sample. For each firm of the sample researchers identified up to three largest owners with the corresponding ownership stakes and level of control. Consequently, the ownership and control structure of the first level owners is sought. The control chain is unwound until the final controller is defined. The ownership chain also goes downward, so that all the subsidiaries of the surveyed firms are also included in the database. Final controllers were classified into five institutional types: foreign companies, federal government, regional government, large private domestic owners and other private domestic owners. The last two categories may be individuals or groups of individuals, united together into alliances if they appear as ultimate owners of the same companies. The controlling ultimate owner is determined using standard definition in literature (La Porta *et al.,* 1999) by tracing the chain of ownership to find who has the most voting rights.

The first stage of the selection process consisted in selecting the largest companies in terms of sales and employment in the main (also determined by size) sectors based on census data. The second stage included adding the identified subsidiaries of these firms. The original sample contained only large Russian legal entities, whereas the final database also includes the subsidiaries of surveyed companies.

Both domestic and foreign owners, individuals and legal entities are present in the current database. The current database contains 2596 entries: 1335 Russian firms with okpo (official identification statistical codes), 42 banks, 610 individuals or groups of individuals, 25 regional governments, 32 federal ministries, 418 intermediaries, 102 foreign companies. In total 45 sectors covered by the database constitute 40% of the total economy by employment and 76.5 %

of industry by sales. The surveyed companies operate in 70 out of 83 regions and account for 75% of industry sales, 33.7% of industry employment, 30% of employment in services and 68.3% of the total bank assets. Table 1 of the Appendix describes the sample representation and contains descriptive statistics of the main variables.

Given the problems of corporate governance in Russia, the survey participants suggested differentiating between the degree of ownership and control. As a consequence, the survey contained two separate questions on ownership stake and control level. While ownership stake is a precise variable, the level of control reflects expert opinion on the ability of the stakeholder to influence key decisions of the company. Part of the additional control comes from affiliated management, part comes from multiple or unregistered shareholdings[4].

Researchers realized there was a need to distinguish two types of domestic owners because of the existence of integrated business groups that control large shares of the economy and/or dominate particular sectors of the Russian economy. By aggregating sales and employment under the control of each ultimate owner, it is possible to calculate his share within the industry or region of operation, as well as in the economy as a whole. Moreover a large sample cover of the survey allows calculating the concentration of ownership inside markets and across the economy. Ownership concentration results across the economy were analyzed by Guriev and Rachinsky (2005). In this chapter we focus on the concentration of ownership and control within the companies.

2.4 Decomposition of Control-Ownership Gap: Methodology

There are several methods of gaining greater control level than is implied the actual share of cash-flow rights. They include use of pyramidal structures, non-voting shares, and other less well observable mechanisms including concealed crossholding and affiliated management. The majority of the literature concentrates on measuring control ownership gap created by the use of pyramidal ownership chains. Some researchers also account for the use of multiple voting class shares. The last method, to the best of our knowledge, has never been accounted for in the empirical studies of substantial samples of companies due to its nontransparent nature. The design of the control variable in our dataset, which encompasses a wider definition of control, allows us to measure the full control ownership gap. The structure of the database also allows us to trace the ultimate owner at the top of the pyramid and to measure his cash flow rights in the companies at the source of the ownership chain. Using this information we are able to single out the pyramidal effect from the total control-ownership gap. The database does not contain information on the multiple classes of shares. This limitation should have a neglectable impact on the results due to the very limited use of these types of shares in Russia in 2003 (Guriev *et al.*, 2005).

The second part of the total control-ownership gap, exercised via less visible control methods is not measured in the literature due to data availability constraints. Often, the implicit assumption is that the control ownership gap equals its pyramid component. Measuring the hidden part of the iceberg for a sample of Russian companies might serve as a useful benchmark for the studies on control-ownership gap in other countries, as well as providing results about Russian companies that are of interest in their own right.

In measuring the control level we follow Claessens *et al.* (2000). Claessens' definition of control relies on voting rights and uses of deviations from one-share}one-vote, pyramiding schemes, and cross-holdings as means of separating cash-flow and voting rights. Suppose a entrepreneur owns 10% of the shares in firm A, which in turn has 20% of the shares in firm B. If there are no deviations from one-share one-vote, it could be said that the entrepreneur owns 2% of the cash-flow rights of firm B. At the same time exercising one's voting rights can be described as the ability to influence a binary variable, therefore control rights transmitted along the chain of companies, could be better measured as the minimum voting stake. In the above example we could say that entrepreneur controls 10% of firm B, or the weakest link in the chain of voting rights.

In order to measure the total control of the ultimate stakeholder, we apply the method of the weakest link in the ownership chain to our *control* variable. We then apply the same method to the *ownership* variable in order to calculate part of the total control that comes exclusively from the use of pyramids. Using the standard definition of the cash-flow rights, we calculate the ultimate ownership share as the product of the ownership stakes along the chain. By applying Claessens' method both to control and ownership variables and comparing the ultimate result we make a novel extension to the existing methodology. Subsequently, we introduce the decomposition technique to separate the factors contributing to control-ownership gap formation .

If α_i is an ownership share of the firm *Xi* in a firm *Xi+1* in the ownership chain leading to the ultimate owner Y, then *chain ownership* share or *cash-flow rights* of Y equals to $\prod_i \alpha_i$. The ultimate owner Y is said to have a *pyramidal ownership* of $\min\{\alpha_1,.\alpha_k\}$, the weakest link in the chain of ownership shares. This is the first component of the total control.

If β_i is a control level of a firm of the firm Xi a firm X_i+1, then *chain control* equals to $\prod_i \beta_i$, then the *pyramidal control* exercised by the ultimate owner Y could be calculated as $\min\{\beta_1,.\beta_k\}$. The control level β_i is based on an expert opinion on the ability of the stakeholder to influence key decisions of the company[4].

Claessens *et al.* (2000) calculate the control ownership gap as the ratio of the *pyramidal ownership* share to the *chain ownership* share $\frac{\min\{\alpha_1,.\alpha_k\}}{\prod_i \alpha_i}$. The more this ratio exceeds the unity the greater is the control exercised via the use of pyramids. This gives us the pure effect of using pyramiding schemes. For reasons of convenience we will refer to it as the pyramid effect and use the notation Λ (lambda).

We calculate the total control ownership gap as the difference between the ultimate control exercised by the final owner , *pyramidal control,* and his cash-flow rights, *chain ownership* share

[4] While not constrained in their estimates by the questionnaire, experts tended to measure control level with in bins of 5 percentage points, e.g. β_i will only take values of 5%, 10%, 15%, etc. . The measurement error from this rounding should not have a big effect on our estimations.

$\Gamma = \frac{\min\{\beta_1,.\beta_k\}}{\prod_i \alpha_i}$. The total control ownership gap can be decomposed in two components: *pyramid effect* and a ratio of *pyramidal control* level to *pyramidal ownership.* For convenience reason we will refer to it as *control variable effect* and use notation K (kappa). $\mathrm{K} = \frac{\min\{\beta_1,.\beta_k\}}{\min\{\alpha_1,.\alpha_k\}}$. The equation for the decomposition is presented below.

$$\frac{\min\{\beta_1,.\beta_k\}}{\prod_i \alpha_i} = \frac{\min\{\beta_1,.\beta_k\}}{\min\{\alpha_1,.\alpha_k\}} \frac{\min\{\alpha_1,.\alpha_k\}}{\prod_i \alpha_i} \quad (1)$$

By taking the logarithms of these ratios we transform the decomposition to its linear form and use small Greek letters for notation purposes. This identity is referred to in further estimations of the control-ownership gap decomposition.

$\ln\Gamma = \ln\mathrm{K} + \ln\Delta;$

$\gamma = \kappa + \lambda$

In order to better illustrate our decomposition method we consider here the example of the Volga Motors company, taken from the World Bank database. This company, producing engines for minivans and boats, has one major controlling owner Ruspromauto-Nizhegorod Cars that owns 65% of the company but controls 80%. Ruspromauto-Nizhegorod Cars is entirely owned by Ruspromauto. Ruspromauto has three major owners, Basic Element (37.5%, 70%), Millhouse Capital (37.5%, 30%) and an individual stakeholder Strezhnev Dmitry (13%, 0%). The corresponding ownership and control shares are respectively indicated in brackets. The excess control exercised by Basic Element is explained by the affiliated management of Ruspromauto. Basic Element is part of the business group owned by Oleg Deripaska, one of the most influential Russian oligarchs. His ultimate ownership share in Volga Motors is 24.375% (65%*100%*37.5%) whereas his pyramidal ownership is 37.5% (min{65%,100%,37.5%}) and his pyramidal control is 70% (min{80%,100%,70%,100%}). In this case the total control ownership gap Γ is therefore 2.87 (70%/24.375%), and is the result of two effects: the control effect K which amounts to 1.87 (70%/37.5%) and the pyramidal effect Λ which equals 1.54 (37.5%/24.375%).

2.5 Ownership Concentration of the Russian Companies

Similarly to companies in other post transition countries, Russian firms have a highly concentrated ownership structure. In half of the companies the main owner has a direct stake of more than 54% and almost a third of all companies have only one owner. The level of ownership concentration at the firm level is slightly higher than in Czech and Polish companies. Grosfeld and Hashi (2007) found that the average share of the largest stakeholder in Czech companies was 51.9% in 1999 and 50.3% in Polish companies in 2000. Given the complex corporate structures that have evolved since the privatization era, the distribution of the direct ownership stakes is not very helpful in understanding the underlying ownership relationships.

In order to identify the ultimate owners we repeat the procedure applied by Guriev and Rachinsky (2005). For each company we choose the owner that has the largest stake and add him to the linear ownership chain that leads from each firm to its ultimate owner. Table 2 describes the average complexity of the ownership chains in Russian companies. Around a quarter of all companies are directly owned by their ultimate controllers, half of the companies have one intermediary owner, and another quarter has three or more companies in the ownership chain.

Table 2: Length of the ownership chain in pyramidal schemes

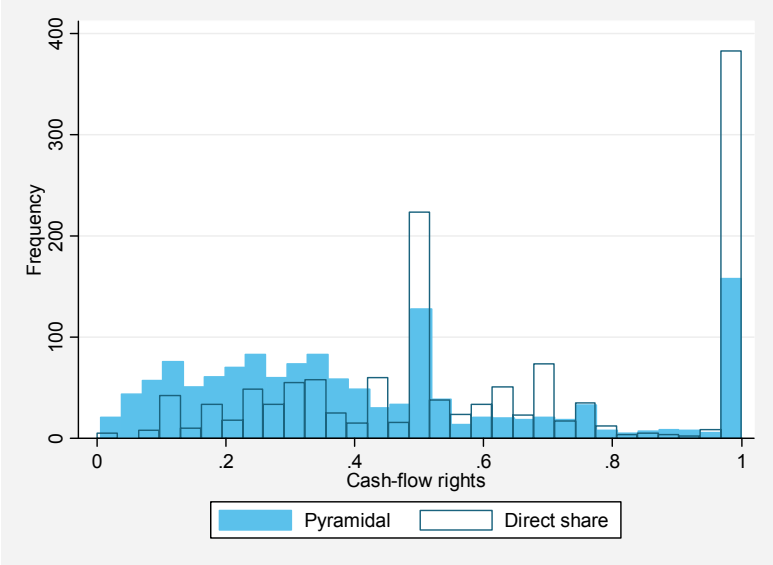
Number of links	Number of companies
5	27
4	69
3	265
2	642
1	368
mean	2.09

In the example of the Volga Motors company described in the previous section, Oleg Deripaska was identified as an ultimate owner of Volga motors via the linear chain of major owners Ruspromauto-Nizhnegorod Cars- Ruspromauto - Basic Element. Hence the ownership chain for Volga Motors equals 4. Another example from the database is Petmol, a milk plant in St. Petersburg that is controlled by Group Planet Management at 65%, while the company's ownership stake in the milk plant is only 25%. In this case the control leverage is exercised via control over debt arrears. Group Planet Management is 100% owned by Millhouse Capital, which belongs to Roman Abramovich with 90% ownership and control.

We use the ownership stakes of all companies in the linear ownership chain of main controllers to calculate the *chain ownership* or cash-flow rights of the final owner. Figure 1 shows the

difference in the distribution of direct ownership stakes and cash-flow rights of the major stakeholder after accounting for the pyramidal leverage.

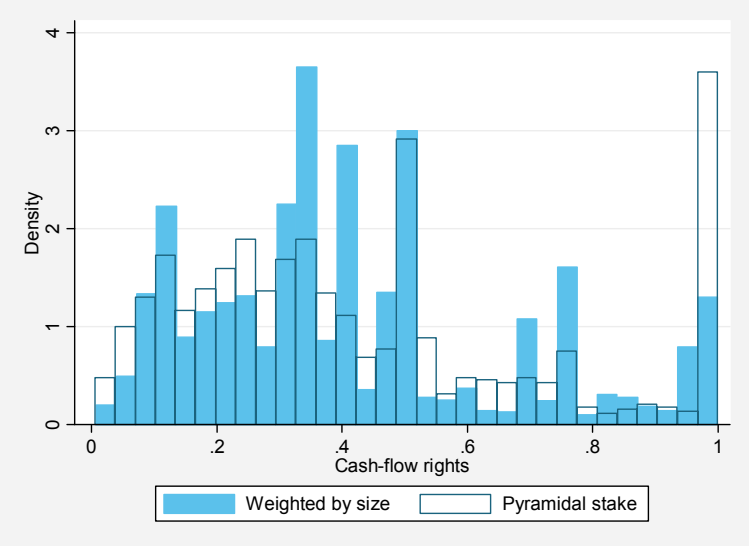
Figure 1: Cash-flow rights of main stakeholder



After accounting for the use of pyramidal schemes, the number of companies with a single ultimate owner is substantially reduced to 142 (10% of total) and the median stake of the ultimate owner comes down to 36%. According to Bebchuk (1999) larger cash-flow rights of the controlling stakeholder imply smaller agency costs imposed by the separation of ownership and control.

Theory predicts that ownership concentration will decline with the size of the company partially due to the limited capital access. This is supported by evidence on the East Asian corporations (Claessens *et al*., 2000). Figure 2 shows additional distribution of the ultimate ownership stakes of the main controllers weighted by the size of the company. The logarithm of companies' sales in 2003 is used as a measurement of company size. Compared to unweighted distribution it reveals whether ownership is more concentrated in larger companies as weighting ownership stake observations by the size of the company increases the relative significance of bigger companies. Wider left tail of the weighted distribution indicates that larger companies have relatively smaller ownership concentration. The sharp fall of the density bar for the 100% ownership stake points out that only relatively smaller companies have a single ultimate owner. This preliminary data investigation shows supporting evidence for the intuitive theory prediction.

Figure 2: Cash-flow rights of main stakeholder weighted by size of the company



Literature devoted to studying the determinants of the control ownership gap indicates institutional type of the ultimate owner as a significant factor. Table 3 contains summary statistics of the ownership concentration of different institutional types of owners. It reveals significant differences in the ownership pattern. Business groups have the lowest cash-flow claims on the companies they control with a median stake share of 30 %, as opposed to 36% for other individual owners. It is worth noting that the federal government has similar pattern to the other private owners with a slightly lower median stake of 35%, while regional governments hold substantially higher ultimate ownership rights with a median stake of 51%. Foreign owners hold the highest share of 87% of the cash-flow rights in the companies they control among all other types of owners. We can also note that within all groups there is a substantial degree of variability in the ownership concentration.

Table 3: Ownership stake of the main stakeholder by institutional type

Owner type	Min	Mean	Median	Max	Links, average	N
Business groups	0.78	36.70	30.12	100	2.07	377
Foreigners	12.45	74.32	87.00	100	1.41	107
Federal government	6.13	42.17	35.00	100	1.76	167
Regional government	1.40	57.33	50.75	100	1.42	88
Other private	0.56	40.17	35.70	100	1.52	628
Total	0.56	43.23	36.12	100	1.74	1367

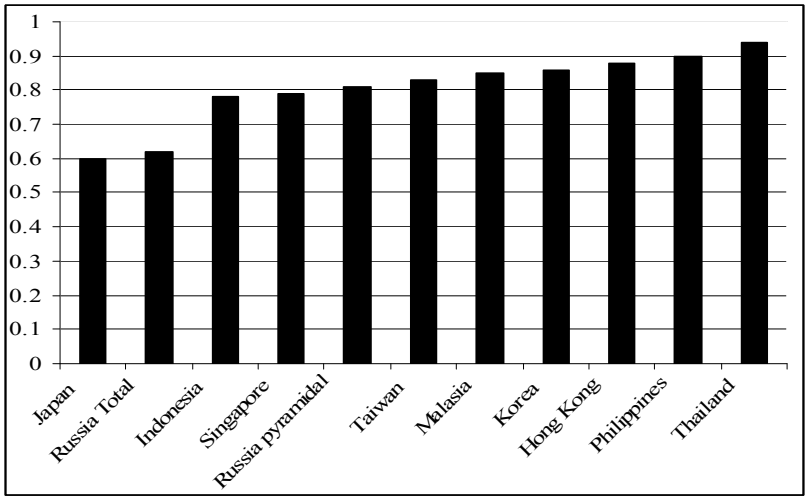
2.6 A Cross-Country Comparison of the Control Ownership Gap

Cross–country studies of the control-ownership gap face the problem of sample heterogeneity, which is exaggerated by the existing differences in the corporate law systems. This poses significant constraints on the interpretations and policy implications of cross-country comparisons of the control and ownership structures. Nevertheless this analysis is necessary and can be very useful proved the results are interpreted with due caution. Given the data limitations and sample heterogeneity we limit our analysis to the comparison of the descriptive statistics published in studies for other emerging and developed economies.

In previous section we calculated that the median stake of the ultimate owner comes down to 36%. Ultimate owners in Thailand hold the highest median ownership stake with 30%, compared with 24% and 20% in Indonesia and Singapore respectively. Japanese controlling owners have the smallest cash-flow rights in their companies, the average pyramidal stake is 9.6% and median is 4% (Claessens *et al*., 2000). Ownership concentration in the Russian companies is high by international standards.

To compare Russia to East Asian countries in terms of the control-ownership gap we have calculated the matching indicator from our database. Claessens *et al.* (2000) accounted for cross-holdings but admitted the limited information availability available relative to other ways of corporate leverage. For our sample of the largest Russian companies we report both the total control ownership gap and the pyramidal effect. In order to ease the comparison we use the inverted ratios $\frac{1}{\Gamma} = \frac{\prod_i \alpha_i}{\min\{\beta_1,.\beta_k\}}$ and $\frac{1}{\Lambda} = \frac{\prod_i \alpha_i}{\min\{\alpha_1,.\alpha_k\}}$ in absolute terms.

Figure 3: Separation of control and ownership in East Asia countries and Russia



We calculate the control-ownership gap based on the ownership numbers and the knowledge of the pyramidal ownership chains. Comparing the average size of the control-ownership gap in different countries, Russia appears to be positioned in the middle of the East Asian countries, between Singapore and Taiwan. However, if we take into account other sources of corporate leverage Russia then moves towards the countries with the highest control-ownership gap ratio, close to Japan. This comparison is probably correct for Japan, but not for other East Asian countries. Due to the lack of information on the total control- ownership gap in other countries, it would still be correct to compare the control ownership gap in Russia with that of other countries based solely on its pyramidal effect of control leveraging.

2.7 Control-Ownership Gap in Russian Companies

Following the methodology described in the section 2.3 we calculate the total control-ownership gap and its *pyramidal (*λ) and *control variable* (κ) components for the sample of the largest Russian companies (Table 4).

Table 4: Decomposition of control-ownership gap

	Control Ownership Gap		
Stats	Pyramidal effect	Control effect	Total gap
N=1367	λ	κ	γ
Mean	0.28	0.40	0.68
(sd)	(0.40)	(0.58)	(0.74)
Share in total gap	0.41	0.59	1.00
N of companies with one effect	438	202	1098
Share of companies with gap>0	0.48	0.66	0.80

The vast majority of companies in our database (80%) have a main owner who exercises control rights exceeding his cash-flow rights. 48% of all companies have control ownership gap that comes from the creation of the pyramidal ownership structures, while in 66% of companies it is exercised via other control enhancing mechanisms. Out of the 1098 companies with a control-ownership gap, 32% have a control gap exclusively coming from the *control variable* effect κ, whereas only 15% of companies exclusively exercise it via pyramidal schemes λ, and 33% of them use both mechanisms.

In terms of the magnitude of the control-ownership gap, *control variable* effect κ is responsible for 59% of the total control-ownership gap, while *pyramidal* effect λ contributes to the remaining 41%. On average, the control level is exceeding ownership rights by 32 % ($e^{0.28}$-1) due to the pyramid effect λ and by 49% ($e^{0.4}$-1) due to the *control variable* effect κ.

These findings highlight the large role of the informal mechanisms in the control ownership leveraging. They also indicate that there are substantial differences in the structure of the two components of the control-ownership gap. In order to understand whether the pyramidal effect can be used as a proxy variable for the total control-ownership gap we need to look at the correlation between the two components and ultimately between pyramidal effect and total control-ownership gap. For this purpose we use the frequency tables of these variables for the reason of their semi-binary structure.

Table 5: Frequency table for the pyramidal and control variable effects

Pyramidal effect (λ) Control variable effect (κ)	λ=0 (no gap)	λ>0 (non-zero gap)	Total
κ=0 (no gap)	269	202	471
κ>0 (some gap)	438	458	896
Total	707	660	1367

Table 5 shows the number of companies in the four groups: with no control-ownership gap, with *pyramidal* effect only, with *control variable* effect only and with both *pyramidal* and *control variable* effect. Out of 896 companies that have *control variable* effect κ only half (48.9 %) would be identified with the use of *pyramidal effect* variable λ. Concurrently, out of 471 companies that do not have *control variable* effect, 202 (42.9 %) have the control leverage coming via the pyramidal ownership structures. These numbers demonstrate that correlation between the *pyramidal* and *control variable* effect is not very strong.

Table 6: Frequency table for pyramidal and total control effects

Pyramidal effect (λ) Total control effect (γ)	λ =0 (no gap)	λ >0 (non-zero gap)	total
γ =0 (no gap)	269	0	269
γ >0 (some gap)	438	660	1098
Total	707	660	1367

Table 6 separates companies into three groups: companies having no control-ownership gap, companies with a pyramidal separation of the control, and those where all control leverage is exercised via alternative mechanisms. By relying solely on the pyramidal effect we can identify 660 out of 1098 companies whose final owners have control level exceeding their cash-flow rights. The correlation between the size of total control-ownership gap and pyramidal gap equals 0.63.

Relying solely on the pyramidal structure information would result in a substantial underestimation of the number of companies that have a control-ownership gap. This means that regression results that use the pyramidal effect as an explanatory variable can not be interpreted as an effect of the total control leverage, due to the fact that a large share of the companies exercising control leverage is part of the no-gap benchmark group. Assuming that non-pyramidal control leverage mechanisms indeed exist in other emerging markets, we conclude that the previously mentioned empirical studies are subject to this problem. Among the two components *control variable* effect κ represents a better alternative due to the fact that it accounts for a larger proportion of the total control-ownership gap.

The low correlation between the pyramidal and the total effect would be less troubling if the *control variable* effect had a distribution independent of the other explanatory variables. We study this question by looking at the relationship between some of the common explanatory variables in the performance and valuation equations and the control ownership gap components.

The institutional type of the controller is considered by the literature as an important factor that can influence company performance. Table 7 contains median values of the control-ownership gap decomposed by the mechanism of control leverage and by the type of owner.

Table 7: Decomposition of control-ownership gap by the type of owner

	Control Ownership Gap		
	Pyramidal effect λ	Control effect κ	Total gap γ
Business groups	0.37	0.57	0.93
(sd)	(0.40)	(0.65)	(0.79)
Foreigners	0.06	0.12	0.19
(sd)	(0.17)	(0.28)	(0.35)
Federal government	0.38	0.15	0.53
(sd)	(0.46)	(0.27)	(0.49)
Regional government	0.18	0.26	0.43
(sd)	(0.32)	(0.60)	(0.78)
Other private	0.25	0.44	0.69
(sd)	(0.40)	(0.60)	(0.76)
	0.28	0.40	0.68
Total	(0.40)	(0.58)	(0.74)

Note: if $\gamma=0$ there is no control-ownership gap

A decomposition of the control ownership gap according to the type of owner reveals a nonhomogeneous pattern. Business groups have the highest corporate leverage on their ownership stakes: they control 2.5 ($e^{0.93}$) times more than the ultimate share of cash-flow rights in their possession. The largest part of the leverage (60%) is exercised via nonpyramidal control channels while pyramidal structures also play a significant role and help to exercise the remaining 40% of the gap.

The smallest gap between the control level and the cash-flow rights is found in the foreign owned companies and constitutes only 20 % on average. However, the relative significance of informal control is similar to that of business groups and equals 63%.

In this respect, federal government represents a different type of ultimate controller. Almost 70% of the control-ownership gap in federal government owned companies come from the pyramidal structures. That is much higher than the Russian economy average of 40%. Regional

government, however, demonstrates a control leverage pattern that is different from the federal government and is to that of business groups. Anecdotal evidence on regional government policies supports the similarity between some regional authorities and business groups. Both federal and regional government companies have a smaller control ownership gap than the other privately owned firms. Smaller private principle owners have a control level that is on average two times higher than their cash-flow rights.

Table 8 shows the percentage of companies with a control ownership gap, classified by the mechanism of control enhancement and the type of owner. This additional breakdown of the control-ownership gap as a binary variable gives another perspective on the differences in the use of the control leverage mechanisms by the different types of owners. 72% of business groups and 71% of other private owners use other non-pyramidal control mechanisms. Interestingly, federal government use other control mechanisms more often than the regional government but with a smaller leverage.

Table 8: Number of companies by the sources of control ownership gap and the type of owner

	Share of Companies with Control Ownership Gap			
$\lambda + \kappa = \gamma$	from pyramidal effect (if $\lambda>0$)	from control effect ($\kappa>0$)	total ($\lambda>0$)	Number of companies
Business groups	0.67	0.72	0.92	377
Foreigners	0.22	0.44	0.51	107
Federal government	0.58	0.54	0.76	167
Regional government	0.33	0.48	0.56	88
Other private	0.41	0.71	0.82	628
Total	0.48	0.66	0.80	1367

The above analysis indicates that regressions including the pyramidal effect λ as proxy of the total control ownership gap γ can be biased due to the endogeneity problem. The error term in this case will include the second component of the total control-ownership gap κ. If this unaccounted component of the gap is correlated with any of the explanatory variables in the equation their resulting coefficients will be biased. We investigate this question by using regression analysis in order to identify whether standard explanatory variables in the performance equations are correlated with the existence and the size of the control-ownership gap. We estimate separate regressions for the total control ownership gap and its two components.

As most of the literature treats the control ownership gap as an independent exogenous variable, there is a lack of sufficient reference material for such analysis. Some studies refer to the

differences in the institutional and regulatory structures of different countries as an explanation of the control-ownership gap. The factors that influence differences in size of the control-ownership gap between the companies are rarely studied. Here we do not intend to explain the variation in control-ownership gap; our aim is to test whether the control-ownership gap is correlated with some of the commonly used explanatory variables.

Valuation and performance models often include together with the ownership concentration or control ownership gap the size of firms, their labour productivity and capital intensity, as well as the institutional type of the owner. We include these parameters in the regressions explaining the total control-ownership gap, the pyramidal effect and the control variable effect. We do not use stock market indicators, also standard in this type of models, as only a small number of companies in our sample are trading on the stock exchange. At first, we treat the control-ownership gap as a binary variable and use the probit estimation procedure. Then, we use the tobit procedure to account for the size of the gap. The following equation specification is similar to the one used by Grosfeld, Hashi (2007) in estimating factors that determine the ownership concentration in Polish companies.

Table 9: Determinants of the control-ownership gap existence (probit estimation)

	Pyramidal effect y=1 if $\lambda > 0$	Control effect y=1 if $\kappa > 0$	Total y=1 if $\gamma > 0$
Business groups	0.617**	0.281	0.797**
	(0.139)	(0.144)	(0.213)
Foreigners	-0.979**	-0.560**	-1.088**
	(0.269)	(0.217)	(0.248)
Federal government	0.221	-0.795**	-0.550*
	(0.215)	(0.210)	(0.240)
Regional government	-0.115	-0.273	-0.695**
	(0.217)	(0.212)	(0.246)
Size (log sales)	-0.202**	-0.078	-0.168**
	(0.044)	(0.044)	(0.059)
Capital/Sales	-0.055	0.012	0.009
	(0.047)	(0.047)	(0.056)
Sales/Labor	0.052	-0.026	0.083
	(0.065)	(0.065)	(0.086)
Industry dummies	+	+	+

Standard errors in parentheses, * significant at 5%; ** significant at 1%

Table 9 contains the results of the estimated probability of having a control ownership gap for different control leverage mechanisms. The regressions also contain industry specific dummy variables, which are not reported. Including additional explanatory variables allows us to identify more clearly the relationship between the gap and the owner type. For example, business group companies are larger on average than other privately owned firms. It might be that the higher

control-ownership gap for business groups, shown above, results from the difference in the size distributions of samples or that there is some industry specific ownership patterns. However, after accounting for additional explanatory variables our main conclusions regarding the total control-ownership gap remains the same: i.e. companies that are part of a business group are exposed to the highest control leverage. For state owned and even more so for foreign owned companies, control exceeds the cash flow rights to a lesser extent than for other private companies. The size of the firm has a negative impact on the existence of a control-ownership gap. This confirms the conclusions of Claessens (2003). Capital intensity and productivity do not show any significant impact on any of the control effects. Marginal effects estimations are presented in Table 9b in Appendix.

Regarding different components of the control ownership gap, the probability of having a control variable effect is negatively correlated with being owned by a foreign company or a federal government. Business groups have significantly higher pyramidal effect which is in agreement with our expectations.

The majority of companies in our sample have a control-ownership gap and there is a large variation in its size starting from 20% ($e^{0.19}$-1) average leverage in foreign-owned companies to 150% ($e^{0.93}$-1) for business group owned firms. In order to estimate the parameters that are related to the size of the gap, we use two stage estimation (tobit method), which is designed for variables that have censored distributions (Table 10). The censored part in our case consists of the companies that do not have any control ownership gap.

Table 10: Determinants of the control-ownership gap size (tobit estimation)

	Pyramidal effect λ	Control effect κ	Total γ
Business groups	0.172**	0.157*	0.218**
	(0.056)	(0.073)	(0.073)
Foreigners	-0.600**	-0.542**	-0.818**
	(0.122)	(0.128)	(0.129)
Federal government	0.091	-0.677**	-0.423**
	(0.091)	(0.125)	(0.117)
Regional government	-0.207*	-0.211	-0.382**
	(0.099)	(0.124)	(0.123)
Size (log sales)	-0.086**	-0.023	-0.069**
	(0.018)	(0.024)	(0.023)
Capital/Sales	-0.010	-0.013	-0.016
	(0.019)	(0.025)	(0.025)
Sales/Labor	0.025	-0.020	-0.002
	(0.026)	(0.035)	(0.035)
Obs uncensored	479	585	723

Results from the Tobit estimations are qualitatively similar to the probit estimation output. However, large changes in the relative magnitudes of the coefficients for different ownership types suggest that the restrictions imposed by the Tobit procedure are influencing the results. While the Tobit procedure accounts for the selection bias by estimating the probability of having a control-ownership gap, it uses the same set of regressors for the probability of having a control ownership gap and for estimating its absolute size. This imposes strong constraints on the corresponding coefficients. To avoid this complication we use Heckman model which allows for different regressors in the selection and principal equation.

Table 11: Determinants of the control-ownership gap size (Heckman model)

	Pyramidal effect (λ)		Control effect (κ)		Total(γ)	
	Size	Select	Size	Select	Size	Select
Business groups	-0.015	0.076*	0.128*	0.018	0.168*	0.063
	(0.039)	(0.033)	(0.061)	(0.041)	(0.067)	(0.095)
Foreigners	-0.298**	-0.108**	-0.385**	-0.017	-0.515**	-0.018
	(0.072)	(0.035)	(0.079)	(0.049)	(0.077)	(0.061)
Federal government	0.027	0.040	-0.364**	-0.008	-0.135*	0.018
	(0.057)	(0.042)	(0.064)	(0.040)	(0.061)	(0.063)
Regional government	-0.039	-0.029	-0.006	-0.005	0.012	0.006
	(0.069)	(0.038)	(0.094)	(0.048)	(0.103)	(0.063)
Size (log sales)	-0.014	0.000	0.010	0.001	-0.017	0.002
	(0.010)	(0.009)	(0.014)	(0.010)	(0.015)	(0.019)

Standard errors in parentheses, * significant at 5%; ** significant at 1%, industry dummies are included but not reported, number of observations is 852.

Results from the Heckman model estimation confirm two previously identified trends: foreign owned companies are less likely to have control ownership gap and if they have a pyramidal or control effect gap it is of significantly smaller magnitude. Business group companies are not more likely to have a control variable effect. However, when they do have a control variable effect, they are likely to exercise higher control leverage. At the same time the firms owned by federal government have control effect gap of significantly lower magnitude.

Both pyramidal and control variable effects significantly differ by the type of owner, however this difference does not have the same structure. These results support the previous argument that using pyramid effect as a proxy variable might lead to biased estimations of the control-ownership effect.

2.8 Conclusion

The empirical evidence on the role and influence of the control-ownership gap on company performance is mixed. One possible explanation might be the existing problems in measuring the total control gap. The largest stakeholders can use several methods to enhance their control over cash-flow rights, however only few of them are usually accounted for in the literature. The missing part of the control-ownership gap variable may be one reason for the incorrect estimations.

This chapter analyses the structure of the control ownership gap in a large set of Russian companies. We decompose the total gap into two components: control over cash-flow leverage coming from pyramidal structures and control gap exercised via the use of less formal mechanisms, e.g. affiliated management, ability to influence board of directors. The pyramidal effect is usually accounted for in the literature, whereas the second control variable effect is normally omitted.

There is a significant difference between companies in the presence and magnitude of the gap. The highest control-ownership gap is exercised by business groups while foreign owners enjoy the smallest divergence between control and cash-flow rights. In addition, the composition of these control mechanisms is not homogeneous across owners. Federal government control leverage comes mainly from pyramidal structures, while regional governments are more likely to use other methods of control enhancement. In Russian companies less than half of the total control-ownership gap comes from the use of pyramidal schemes. This means most companies have additional control leverage mechanisms. The correlation between pyramidal and control variable effects is weak, while the latter is correlated with some of the standard explanatory variables used in performance equations.

These conclusions suggest that standard estimators might be weakened by the presence of the endogeneity problem and measurement errors. These results also have strong implications for countries where informal control is dominant. Namely, that using the narrow control gap definition for estimating valuation effects may lead to the erroneous rejection of causality.

Chapter 3: Business Groups Impact on Performance of Companies

3.1 Motivation and literature review

High economy-wide concentration of ownership in the hands of a small group of individuals became a well-known characteristic of the Russian post-privatization economy. The rapid growth of their assets following the 1995-1996 "loans-for-shares" auctions organised by the government before national elections, earned them a negative press. Oligarchs' (a term commonly used for Russian business groups) significant influence has been in the centre of the public debate since then. The first comprehensive attempt to quantify their economic impact was made by the World Bank country economic memorandum in 2003, and it found that business groups control around 40 % of total sales in the 2003 sample.

Similar ownership consolidation processes happened in other transition economies. The emerging pyramidal structures were often compared with East Asian business groups with similar duality in public attitude. Some saw them as catalysts for restructuring and productivity growth. Others had concerns regarding the possible spread of rent-seeking and asset tunnelling practices. Despite high interest from economists and policy makers, few studies attempted to systematically estimate the impact of business groups on the economic performance of their companies or on social welfare in Russia. This chapter contributes to filling this gap.

Business groups play a significant role in many emerging economies (Korea, Thailand, Chile, India, Mexico, Turkey, as well as Ukraine) as well as in some developed economies Italy, Sweden, Canada). Their economic phenomenon is an object of study by several branches of economic theory: firm theory, industrial organisation, finance, and development economics. Macroeconomic analysis also includes references to the presence of large influential players. Such cases include studies on East Asian countries conducted after the 1997 financial crisis. There is no consensus both in theoretical and empirical studies regarding the impact of business groups on the welfare and performance of companies under their control.

Before discussing the literature results on business groups' impact, it is important to define the term *business group*. Leff (1978) provided a wide definition of a business group as "a group of companies that does business in different markets under a common administrative or financial control linked by relations of interpersonal trust, on the basis of a similar personal, ethnic or

commercial background". Subsequently, the theoretical and empirical literature has shifted towards a narrower definition of business groups based on equity cross-holdings or pyramidal structure of ownership (Almeida and Wolfenzon, 2006a). This approach is practical from the modelling perspective as well as from the limited data availability. However, there are studies pointing to the adverse effect of missing out other group connection mechanisms (Khanna, T., 2000).

In this chapter we use the pyramid based approach to define business groups. In addition to information on equity stakes we have access to control level data. In contrast with studies that rely exclusively on equity variable, we are able to identify business groups' boundaries using information on control levels and therefore remove the bias introduced by omitted group connections.

The vast volume and diversity of the literature studying business groups reflects the comprehensive nature of this economic phenomenon. The majority of the literature can be classified into two fields. The first one has its origins in the Coase's transaction cost theory (1937) developed and refined by Alchian and Demsetz (1972) and Williamson (1975). It often predicts superior performance of business group companies in developing economies. The main explanation is that business groups fill in the institutional voids by providing alternative mechanisms needed for the normal functioning of the market. This way business groups help stimulate economic growth. Within this field of literature there is a separate branch that studies internal capital markets run by business groups. Its predictions differ by country.

The second field focuses on the inefficiency of corporate governance of large diversified groups and often predicts underperformance of the affiliated companies. Its origins have common grounds with studies on conglomerate valuation "discount" in the U.S. conducted in the 80s. The explanatory models often use the toolkit of agency cost theory and incentive mechanisms. These studies predict that divergence between control and ownership enhanced through the pyramidal structures leads to asset tunnelling and expropriation of the rights of minority shareholders. The result predicted is a lower valuation of the affiliated companies (Claessens *et al.*, 2002; Claessens, Djankov, 1999).

Using the transaction approach, Leff (1978) pioneered the theory of business groups as a response to market failure and was the first one to draw academic attention to the important role of "economic groups" in developing economies. One of his findings is that "the group pattern of

industrial organization is readily understood as a microeconomic response to well-known conditions of market failure in the less developed countries". Further studies of business groups elaborated on the different aspects of the problems outlined by Leff (1978) including internal capital markets, contractual and risk-sharing mechanisms.

Kali (2002) analysed business groups from the contractual theory perspective. At the initial stages of economic development explicit contracts are not strong enough and relational contracts complement them. At this stage business groups expand in size, scope and increase the strength of ties. As development proceeds, a threshold is crossed after which business groups begin to unravel. Kali (2003) looked at group connections as a more cost effective way to achieve risk-sharing. These connections replace the functions of the stock market. The author predicted dissolution of business groups once the market institutions take over. This forecast however is opposed by other studies that show that dominance of business groups in the economy might prevent the development of necessary market institutions.

In several papers (Khanna and Palepu, 1999; Fisman and Khanna, 2004) Khanna advocated the important role that business groups play in emerging economies by taking over the role of weakened institutions. The authors showed that Indian business groups are more likely to be located in the poor areas and constitute a crucial factor for facilitating development. Castaneda (2007) found similar evidence by studying the Mexican economy in the aftermath of the 1995 financial crisis. He argues that the internal capital market operated by business groups created a financial cushion that kept the economy working after the banking system had collapsed. He found evidence that business groups helped to achieve a fast and steady recovery of the economy.

The contractual theory approach was extended by Hainz (2007) who focused on the enforcement of contracts among the functions of missing institutions. She models business group structure with vertically integrated production process and the internal capital market. Thus, business groups' organizational mode and financial structure allows for a self-enforcing contract to be designed. This theory contributes to the explanation of why business groups tend to perform better in emerging economies.

Carney (2008) questions the institutional void theory. He uses evidence from East Asian companies and shows that even when substantial progress is made towards developing appropriate market institutions, business groups do not unravel or dissolve.

In the worst case scenario, a substitution of the institutions that should be state provided can instead turn into the state capture. Majumdar and Sen (2007) construct a model that explains the formation of business groups through rent-seeking behaviour and coordinated lobbying and resulting in state capture. Business groups are presented as coalitions of firms, owned by the same family, who engage in coordinated lobbying activities. The welfare impact is negative as a result of the resources lost on the unproductive activities. The authors find substantial empirical evidence by studying Indian business groups. Similar results were found by and Yakovlev and Zhuravskaya (2003) for a number of Russian regions.

The analysis of internal capital markets, common inside business groups in many countries, produces ambiguous outcomes. Cestone and Fumagalli (2005) model the internal allocation of resources within a business group and successfully explain both winner picking and cross-subsidization strategies.

Almeida and Wolfenzon (2006) look at the economy wide effects of internal capital markets run by business groups. They conclude on the negative effect of business groups on the finance market development and hence on the creation of new businesses. Their model predicts that, in the equilibrium state, business groups will direct capital to less efficient affiliated companies.

Gopalan *et al.* (2007) study the internal capital market functioning in Indian business groups. The authors conclude that the main rationale for internal capital market creation is cash transfers necessary to prevent bankruptcy of group-affiliated companies. They do not assess, however, their positive or negative impact on companies.

Apart from solving contractual or risk-sharing tasks, business groups are believed to be formed with the motive of searching for market-power. This assumption is used by Feenstra *et al.* (2003). He models both vertical and horizontal integration with endogenously determined number and size of each group. The model has multiple equilibria with different degrees of integration all consistent with the groups profit maximising behaviours. Mahmood and Lee (2004) also look at the market power exercised by business groups and its impact on innovation. They conclude that share of business groups in the industry can be a good proxy for barriers to enter in the industry. High barriers to entry have a negative impact on innovation.

The second field of the literature on business groups evolved from the ideas of Berle and Means (1932) who investigated the incentives of professional managers of public corporation from the

agency costs perspective. Jensen and Meckling (1976) showed that agency costs increase when the controlling shareholder owns smaller share in the company. Wolfenzon and Almeida (2000) explained the formation of business groups as pyramidal structures enabling the controlling entrepreneur to maximise assets with minimum capital costs. They argued that business groups can be efficient for the family but not for the social welfare.

Further studies focused on the separation of ownership and control generated by the pyramidal structures. Djankov and Lang (2000) showed that a diversion of control level from ownership rights has a negative impact on companies' valuation. Following the Asian financial crisis a new wave of literature emerged showing that business groups in East Asia had corporate governance problems and minority shareholder expropriation that ultimately lead to their underperformance.

Empirical testing of business groups' effect is often based on ad hoc assumptions and incomplete data. This often prevents the necessary distinction between the various mechanisms of their impact. Several theoretical models are often referred to in order to motivate the empirical question and/or used later to explain the results. Table 12 contains a list of additional empirical studies with a brief classification of the methods and results.

For a long time the empirical literature on business groups was dominated by studies of East Asian countries. This was motivated by a very significant role played by zaibatsu and later keiretsu in Japan as well as chaebols in Korea. While Japanese business groups were found to have negative impact on their companies' performance (Caves and Uekusa, 1976), early studies on Korean business groups revealed opposite results. Chang and Choi (1988) found evidence that group affiliated firms show superior economic performance.

A number of studies concluded that group affiliation in Korean companies had negative effect (Ferris *et al.* 2003). Some argued that the impact depends on the size of the business group or the number of companies (Choi, 2002; Chu, 2004). The explanations of underperformance include cross-subsidisation, conglomerate "discount" due to inefficient diversification. The diversification factor refers to the literature on the American conglomerates that were subject to a discount in valuation (Lang and Stulz, 1994). Bertrand *et al.* (2002) studied Indian business groups finding evidence of significant amount of tunneling, much of it occurring via non-operating components of profit.

Research on Russian business groups is largely qualitative in nature with an accent on the political and social consequences of their existence (Boone and Radionov, 2002; Aslund, 2004). There are few studies with a comprehensive estimation of the economic impact of business groups. Perotti and Gelfer (2001) studied the performance of 71 listed companies and found that Russian financial-industrial groups allocate capital more efficiently than independent companies.

Guriev and Rachinsky (2005) conducted the first large scale quantitative study of the impact of oligarchs on the performance of companies. The authors found that oligarchs run their empires more efficiently than other Russian owners. Their estimation techniques included standard total factor productivity (TFP) growth model for two production factors: capital and labour, controlling for industry, territory and ownership. The time period covered years 2001 and 2002. Estimations with the TFP model in levels did not reveal any difference between oligarchs and other owners. However, their study is subject to two lines of criticism. The main weakness of their estimations is to ignore the possible endogeneity problem. The authors admit that their results are not robust to endogeneity and that using instrumental variables for the ownership variable would produce more reliable results. The second problem comes from the limited time period analysed and the high noise level in the Russian statistics.

In their study of Ukrainian business groups, Gorodnichenko and Grygorenko (2007) addressed the possibility of endogeneity problems and found that oligarchs have a positive effect on the productivity of their companies. The authors argued that this result is achieved partially via extracting synergies of vertical integration and substituting for the underdevelopment of institutions. A general summary of research on corporate governance in Russia can be found in Iwasaki (2007). The majority of corporate governance studies focus on the comparison of privatised companies versus non-privatised.

Khanna and Yafeh (2005) analyse the divergence in conclusions on business groups effects. Their two major findings state that business group impact is dependent on country specific economic parameters and that this effect can be beneficial for some part of society (e.g. affiliate companies) and at the same time negative for others. Morck, R., & Nakamura, M. (2007) formulate the conditions under which business groups can have positive impact on welfare. The authors argue that some economies need a coordinated “big push” to bring them to a higher level of growth and development. In this case, business groups are a better alternative to the state due to the rivalry between different groups. However, the success of this approach requires economic openness, basic public goods, rule of law, separation of the state from business, and dissolution

of the business groups when the targeted level of development is achieved. The authors warn that failure to meet these criteria leads to growth stagnation and oligarchic entrenchment.

In addition to these conclusions Khanna and Yacef (2005) list several common methodological problems that can also be partially responsible for the difference in results. One of the most common methodological shortcomings is a failure to account for the endogeneity problem, which results in the persisting doubts regarding the comparability of affiliated and non-affiliated companies. Factors and processes behind the formation of business groups remain largely unstudied. Sanchez-Ballesta and Garcia-Meca (2007) in their meta-analytical study of ownership effect on firm performance analysed 33 studies and found that empirical results in this field are often conflicting and inconsistent. They revealed that the governance system, measurement of performance, and control for endogeneity are important and usually moderate the significance of the ownership effect on the firm performance.

Our study builds on the results of Guriev and Rachinsky (2005) with an attempt to address the methodological problems like endogeneity and the high noise content of the performance indicators. We use the instrumental variables method to address the endogeneity problem. In order to reduce the sensitivity of the results to measurement errors (noise content) we apply long difference estimators. The time period analysed extends from 1999 to 2003 in order to improve the estimations on comparative performance of business groups companies. As the ownership data is available only at a single point of time – mid 2003, in terms of the measurement errors including 2003 observations it is as good as using 2002, assuming there is equal probability of the change in ownership status during the year. Extending the sample several years backwards contains a larger risk of increasing measurement errors in the ownership variable. However, taking into account that large shifts in ownership structures happened during the loans-for-shares auctions of 1995-1996 and later after the 1998 crisis, we believe that changes in the ownership from 2000-2002 were minor compared to previous waves of mergers and acquisitions in Russia.

Table 12: Selected empirical literature results of the business group effect

Article	*Country*	*Year*	*Sample*	*Dependent Variable*	*Method*	*Results*
Barnes, 2003	Russia	2000	14 large BGs		qualitative	Examines the history of formation and close ties with state of the Russian business groups
Bertrand et al, 2002	India	1989-1999	1000 firms	Profit	OLS, FE	Business groups companies have significant amount of tunneling, that is partially reflected in valuation
Bianco and Nicodano, 2006	Italy	1992, 1996	92 groups	Debt/Assets	OLS, FE, robust	Positive correlation between company's external debt and the entrepreneur's cash-flow share
Buzzacchi and Colombo,	Italy	1981	25 groups	Ownership	OLS	Economies of scale, R&D intensity, and specialization of human capital contribute to group formation
Caves and Uekusa,	Japan	1976				Group-affiliated companies have lower profits
Chang and Choi, 1988	Korea	1982	30 largest BG	Profit/Equity, Profit/Assets	OLS, weighted	Business group affiliated companies show superior economic performance
Chang, 2003	Korea	1986-1996	419 chaebol affiliates	Profitability Firm Value	2SLS	Performance determines ownership structure but not vice versa
Choi and Cowing, 2002	Korea	1985-1993	91 affil., 161 unaffil.	Profits		Diversification has no effect on profits, quadratic relationship exists between group profits and the number of member firms
Chu, 2004	Taiwan	1997-1999	340 affil. 423 unaffil.	ROA, Tobin's q	OLS	Group affiliation can not always create value for member firms. The size of the business group matters.
Ferris et al., 2003	Korea	1990-1995	30 largest BG, 250 unafil.	Value, Return	Com. stat, OLS	Chaebol-affiliated firms suffer a value loss relative to non-affiliated firms due to cross-subsidization of inefficient companies.
Fisman and Khanna,	India	1993	>1000	State	OLS, non-	Group-affiliates are more likely to (profitably)

2004			firms	development	linear	locate in less-developed states than unaffiliated firms
Gonenc et al, 2007	Turkey	2000	123 affil., 77 unaffil.	ROA, or Tobin's q.	OLS	Group affiliation improves firm accounting performance, but not stock market performance.
Gorodnichenko and Grygorenko, 2008	Ukraine	1993, 2002	2000 listed	TFP	OLS, endogeneity	Oligarchs increase productivity of their companies by exploiting synergies of vertical integration
Guriev and Rachinsky, 2005	Russia	2001	1005	TFP	OLS, FE	Oligarchs have positive effect on productivity growth
Khanna and Palepu, 2000	India	1993	655 affil., 654 unaffil.	Tobin's Q	OLS, clusters	Affiliates of the most diversified business groups outperform unaffiliated firms
Kim, 2006	Korea	1991-1998	around 2000 a year	TFP	Fama-MacBeth regression	Positive relationship between family ownership concentration and productivity performance is stronger in chaebol firms than in non-chaebol firms
Lensink et al., 2003	India	1989-1997	694	Investment/ Cash-flow	OLS, GMM	Group affiliated companies have softer financial constraints
Perotti and Gelfer, 2001	Russia	1995,1996	71	Investment/ Assets	OLS	Group firms allocate capital comparatively better than other firms, presumably because the controlling bank has a stronger profit motive and authority.

3.2 Data and Variables

Our study is based on two datasets: 1) the World Bank dataset on Russian companies' ownership and 2) the Russian industrial registry. The World Bank dataset contains information on the level of ownership and control for a sample of the 1335 largest industrial companies. A description of the survey sample selection, method and variable definitions are presented in *Chapter 1. The* Russian industrial registry, Goskomstat, contains sales, assets and employment information from 1996-2003. Goskomstat data is prone to significant measurement errors and required substantial cleaning. Preliminary data scanning revealed a considerable amount of mistypes and errors. Some were easily identifiable through validity and arithmetic checks, e.g. negative values for sales and employment or year entered instead of sales number. Eliminating other mistakes in data recording appeared to be more problematic due to the need of distinguishing them from the genuine outliers. To that end we used a general procedure, designed by Thompson and Sigman (1999) that uses the resistant fence method depending on the distribution skewness, sample size and correlation ratios.

The resistant fence method identifies outliers in the data by the following procedure: a) given an ordered distribution of economically meaningful ratios of studied variables, q_{25} -the first quartile, q_{75} - the third quartile, and $H = q_{75} - q_{25}$, the interquartile range are calculated; b) ratios x are flagged out as outliers if $x < q_{25} - kH$ or $x > q_{75} + kH$. Thomson and Sigman (1999) recommend setting constant k equal to 1.5 for the inner fence and 3 for the outer fence.

We apply the resistance fence method to the 1996-2003 companies' data, classified by the first two-digit of the five-digit Russian industrial code. A logarithmic transformation of variables ratios is used to meet the symmetry requirement of the resistance fence method. We construct variables ratios with relevant economic meaning for our future analysis, e.g. sales and productivity growth. In order to identify entry errors in employment and sales growth rates we define 1) the ratio of the observation value at time *t* to its lagged value at time *t-1* and 2) the ratio of the observation at time *t+1* to the value at time *t*. This enables to identify the year of the outlier. Observation is dropped out if both of the ratios are outside the identified fence.

Following Thomson and Sigal's recommendation (1999) we apply the inner fence rule for editing ratios of the highly correlated variables like sales, employment and their lagged values. We drop the observation if the following combinations of variable ratios fall outside of the inner

interval: 1) labour productivity, sales *t* to sales *t-1* and sales *t+1* to sales *t* 2) labour productivity, employment *t* to employment *t-1* and employment *t+1* to employment *t*. Looking at the backward and forward growth rates allows us to identify the time of the erroneous data entry. Controlling for the labour productivity increases our chances of distinguishing between measurement errors and changes in company performance parameters due to restructuring.

The extended fence method procedure allows improving the quality and information content of the analyzed dataset. Table 13 contains summary statistics of variables before and after data cleaning ; sales data entries are more prone to errors than employment data. As a result of data cleaning, the correlation between employment and sales goes from negligible 0.03 to 0.35 (all Goskomstat survey). Note that the correlation between sales and its lagged value also improves substantially.

Table 13: Summary statistics and data cleaning description

	1996	1999	2000	2001	2002	2003
obs total	698	1235	1293	1276	1143	1114
obs, cleaned	598	997	1076	1121	976	944
corr(s,n) total	0.83	0.78	0.79	0.78	0.72	0.77
corr(s,n) cleaned	0.84	0.82	0.83	0.82	0.81	0.82
sales, million rubles[5]	651	1165	1815	2109	2558	3390
employment	3693	2572	2582	2580	2557	2565
assets, million rubles	1687	1534	1663	1904	3209	3766

Our method of data cleaning is different from the one used by the previous study on the same data. Guriev and Rachinsky (2005) used a 1 percentile truncation method. For the major part of our analysis we report the estimations using the data cleaning method described above, except *Section 3.5.2* where we aim to replicate Guriev' and Rachinsky's results.

To estimate business groups effects on company performance we estimate the total factor productivity function $y=f(k,l)$, where y – output, k-capital, l-labour. Our assets variable is an approximation for capital variable. As the data cleaning shows, it is most problematic and has the highest noise content. For these reasons, we also test the sensitivity of our results to the quality of the assets variable. To that end we assume output elasticity of capital β to be exogenously given and exclude capital from the list of explanatory variables. While in the main estimations dependent variable is ln(Y) and regressors include ln(L) and ln(K), for the sensitivity test the dependent variable becomes ln(Y)-βln(K) and the regressors include ln(L) but not ln(K).

[5] 1996 numbers in billon, before denomination

3.3 Russian Business Groups: Definition and International Comparison

World Bank survey distinguished five types of owners: federal government, regional government, foreign companies, large private owners, i.e. business groups or oligarchs, and other private owners. By aggregating sales and employment under the control of each ultimate owner the researchers of the CEM 2003 World Bank survey ranked controlling owners. 22 of the largest owners, satisfying the criteria of the 2001 total group sales exceeding 20 billion rubles (that is, $700 million) or total employment controlled by the group being above 20,000 people, composed the list of business groups, i.e. *oligarchs*.

Detailed description of business groups' industrial specialization could be found in Guriev and Rachinsky (2005). Table 14 contains sample summary statistics for the year 2003 according to the type of owner.

Table 14: Sample statistics, 2003 by the type of owner

	Obs	Sales, mln rub*	Empl	Assets, mln rub*
Owner type				
Business groups				
mean	411	4,401,964	3077	4,734,042
median		626,392	914	352,739
Foreigners				
mean	62	2,666,232	832	1,260,010
median		1,119,715	658	520,830
Federal government				
mean	100	6,288,616	4044	10,749,867
median		3,383,063	2713	4,090,103
Regional government				
mean	56	4,661,751	3556	4,368,197
median		868,651	1392	347,313
Other private				
mean	359	1,537,037	1778	1,281,405
median		640,387	805	239,170
Total				
mean	996	3,459,009	2588	3,893,507
median		777,272	922	367,969

*average exchange rate in 2003 1$US =30.68 Rubles

Business groups control 40% of the total sales in the World Bank sample Guriev and Rachinsky (2005) note; however, that when extrapolating this share to the whole economy caution should be exercised as the sample sales are a proportion of the whole economy and the rest of the economy can have a different structure.

At 40%, share of Russian business groups in the economy is close to the Korean chaebols' in 80s. Chang and Choi (1988) found that "the thirty largest business groups accounted for 40.7% of the total value of shipments in the manufacturing sector as of 1982."

Khanna and Yafeh (2005) conducted a comprehensive study of the business groups in a number of countries. Their results include business groups' size, diversification, and integration, effect on profitability and market returns. We calculated comparable indicators for the Russian business groups based on the comparable data availability. Table 15 compares Russian business groups to other emerging economies and East Asian countries.

Table 15: International comparison of Russian business groups

	Years	Firms	Group firms	Size group / Size unaff	Group diversification
Russia	*99-03*	*944*	*411*	*2.6*	*6.1*
Argentina	90-97	25	11	5.5	
Brazil	90-97	108	51	2.5	1.4
Chile	89-96	225	50	18.7	5.1
India	90-97	5446	1821	4.4	4.2
Indonesia	93-95	236	153	2.8	2.1
Israel	93-95	183	43	5.0	
Korea	91-95	427	218	3.9	1.7
Mexico	88-97	55	19	2.3	2.7
Philippines	92-97	148	37	3.4	3.1
Taiwan	90-97	178	79	2.0	1.6
Thailand	92-97	415	258	2.3	3.5
Turkey	88-97	40	21	1.0	
Japan Prewar	32-43	58	17	6.8	
Japan Postwar	77-92	1002	94	8.5	

Source: Khanna and Yafeh (2005), our estimates for Russia

Note: Group diversification is measured as the number of 2-digit industries in which the group operates. Size group/size unaff is a ratio of median size of affiliated firms to median size of unaffiliated firms

Russian business groups are similar to the business groups of other countries in terms of controlling larger companies. Difference in size with the unaffiliated firms is moderate, similar to one of Brazilian and Thai business groups and significantly lower than in Japan or Korea. At the same time Russian business groups have high level of diversification with the average number of industries equal to 6, higher than the record Chilean group diversification level of 5.1 sectors.

3.4 Ownership effect on performance: methodology

In order to estimate the impact of business groups and other owners on company performance we use the total factor productivity (TFP) model with the owner dummy variables among explanatory variables. This method is commonly used in literature studying the impact of private versus state owners on the performance of companies (Djankov and Murrell, 2002). It includes uses of capital and labour as *X*s and output (often sales) as *Y*, dummy variable coefficient measures the effect of ownership on total factor productivity. Absence of the single theory on the way ownership affects performance results in the multiple representations in modelling predominantly based on ad hoc assumptions. We estimate 2 types of production function: the log-linear Cobb-Douglas specification and the more general, however less commonly applied translog form (log second order Taylor expansion).

In their meta-analytical study of quantitative research on enterprise restructuring in transition economies, Djankov and Murrell (2002) show that performance indicators (sales, productivity etc) or their respective growth rates are widely used to estimate company performance. They note that this choice is often determined by the data available and that it does not play a significant role if lagged performance parameters are used in the equations. We estimate both structural forms of business group effects on company performance: 1) shift in productivity levels 2) productivity growth changes caused by the new type of owner.

The vast majority of business group studies exploit the cross-section variation due to data limitations and a tendency to use the most recent data (Khanna and Yacef, 2005). For our estimation purposes we merge the cross-section World Bank ownership dataset with the Goskomstat dataset, which contains panel data on company performance. Assuming the ownership structure remained relatively stable after 2000, we estimate TFP models on the panel data. We acknowledge potential measurement errors in the ownership variable. However, considering that the majority of business groups were formed during the loans-for-shares auctions of 1995-1996 and in the year following the 1998 crisis (Iwasaki, 2007) , we believe these errors should not bias our results significantly. This section outlines the problems arising in estimating panel data models, as well as the problems related to a high content of measurement error in performance variables, and the main methods to address them.

3.4.1 Estimating TFP in levels

We use the standard notation for the log linear Cobb-Douglas production function:

$$y_{it} = \alpha + \sum \beta x_{it} + \gamma z_{it} + v_{it} \quad (2)$$

In the general formulation, ownership effects are γz_{it} and can vary over time. In this section, we assume that $\gamma z_{it} = \gamma d_i$, so that the ownership effects are time-invariant. In the next section, we allow them to be time-varying: $\gamma z_{it} = \alpha t + \gamma d_i t$

We begin our analysis by assuming that the owner has an effect on the company's performance level rather than its growth:

$$\gamma z_{it} = \gamma d_i \quad (3)$$

For notational simplicity we limit the number of production factors to one and denote this factor by *x*. We also limit the ownership dummy variable *d* to one. *i* identifies each firm and *t* the time. The owner's impact on the company under his control can be estimated by means of three methods:

1) Pooled cross-section

$$y_{it} = \alpha + \beta x_{it} + \gamma d_i + u_i + e_{it} \quad (4)$$

2) Cross-section at different points of time

$$y_i = \alpha + \beta x_i + \gamma d_i + u_i + e_i, \text{ t is fixed (year 1999, 2000, 2001, 2002, 2003)} \quad (5)$$

3) Between estimator

$$\frac{\sum y_{it}}{\tau} = \alpha + \beta \frac{\sum x_{it}}{\tau} + \gamma d_i + u_i + \frac{\sum e_{it}}{\tau} \quad (6)$$

$$\bar{y}_i = \alpha + \beta \bar{x}_i + \gamma d_i + u_i + \bar{e}_i \quad (7)$$

The standard literature on enterprise restructuring sometimes assumes the time invariant error term u_i to be correlated with the explanatory variables $x_{it} : corr(x_{it} u_i) \neq 0$, whereas time dependant errors e_{it} are assumed to be uncorrelated with these variables : $corr(x_{it} e_{it}) = 0$ (Djankov and Murrell, 2002). u_i can include the difference in management quality or other unobserved factors that influence capital investment and the employment decisions of the firm. This assumption can lead to the upward or downward bias of coefficient estimators depending on the sign of the correlation between the error term and the explanatory variables. In this case consistent estimates are usually acquired by using first differences (FD), e.g. estimating models

of growth rates, or fixed effect method (FE). FD and FE contain equation transformations that eliminate u_i, leaving only e_{it}, which is assumed to be uncorrelated with x_{it}. FD and FE methods do not allow estimation of the impact of the effect of ownership on productivity levels, because the FD and within transformations wipe out the time-invariant ownership effects. The FD and within transformation do not, however, wipe out the ownership-specific time trends, and therefore these methods allow estimation of the impact of ownership on productivity growth; we return to these estimators later.

Mairesse (1990) in the study of times-series versus cross-sectional estimations questions the widespread assumption of the error term structure, in particular the fact that it is exclusively the time invariant component of the error term that can be correlated with explanatory variables. To demonstrate his argument Mairesse uses an example, that time variant error term e_{it} usually contains all the effects of overtime labour work and capital equipment usage adjustments to demand. Practices of the kind are not rare, even more so in Russia and other transition countries where informal labour relations are more widespread. This strengthens the validity of the argument in favour of a non-zero correlation between the error term e_{it} and the explanatory variables.

Mairesse (1990) shows that if $corr(x_{it}e_{it}) \neq 0$, "between estimator" can give less biased coefficients. As the time-variant error is averaged, its effect will decrease with the raise in the number of periods.

In his paper Mairesse focuses on the difference between time-series and cross-section estimates. He argues that with the advance of panel data econometrics these discrepancies require additional explanation. Previously used data heterogeneity explanation is not appropriate any more. To strengthen this argument he analyses six types of estimators: OLS in levels, between and within estimators in levels, OLS in first difference, between and within in difference.

By estimating production function for Japan, France and US, Mairesse finds significant discrepancies in the estimates of capital and labour elasticity. He subsequently demonstrates that elasticity coefficients ranks of the six types of estimators are the same in all three countries. This supports the hypothesis of the existing biases in the estimates. Mairesse then analyses the error variances and derives formulas to estimate the biases. He concludes with questioning the widespread preference for time-series (Fixed effect) estimates rather than cross-section ones (between). The Mairesse demonstration of the relationships between the between estimator, FEs

and FDs has not received rightful consideration in the related literature. We report "between" estimates for both levels and growth rates model specifications, and refer to Mairesse's conclusions in our interpretations and comparisons of estimates.

Certain characteristics of our sample, e.g. differences in firm's parameters depending on the owner types, require additional model modifications. Certain divergence of the true production function from its loglinear specification (Cobb-Douglas) of the first order will bias our results. For example, positive correlation between output and capital intensity combined with the fact that business group owned companies have higher capital intensity on average will result in significant positive impact of business group ownership on the performance of companies, even in the situations when it is not the case. We apply two methods to address this problem. 1) We use the translog production function, that accounts for more complex production factor interrelationships and

$\ln Y = \alpha + \beta_1 \ln K + \beta_2 \ln L + \beta_3 \ln K \ln L + \beta_4 \ln K^2 + \beta_5 \ln L^2 + u$ 2) Estimating separate equations for different owner types. Technically the second option is implemented by interacting ownership variables with the factors in a single regression which is equivalent to estimating separate equations.[6] The method we used allows testing of cross-equation restrictions. The use of a cluster-robust covariance matrix means that this can be done without having to obtain explicit estimates of the cross-equation covariances. The Cobb-Douglas function poses restrictions on the constant elasticity of capital and labour, which might not be suitable when estimating cross-section data from many industries. The Translog function does not have this constraint and allows the factor elasticities to change with levels of production factors.

3.4.2 Estimating TFP in growth rates

A number of quantitative studies on privatisation effects conclude that a change in the ownership structure can have an impact on growth rates. We proceed with investigating business groups' and other owners' influence on the growth rates of their companies. This could be presented as:

$$\gamma z_{it} = \alpha t + \gamma d_i t \qquad (8)$$

For convenience purposes we use the following notation t = -2, -1, 0, 1, 2 corresponding to 1999, 2000, 2001, 2002, 2003 years, so that $\bar{t}$ =0. Let us define T as the last period and τ as the total

[6] We do not interacting factor coefficients with industries in order not to lose a clear distinction between productivity effects vs. economies of scale and similar effects. With the same technology across industries ownership effects show up clearly and solely in their impact on factor productivity. If the technology varies across industry we will not be able to easily separate between the effects of ownership (via an additive ownership term) and the effects industry-varying production function coefficients.

number of periods. We can estimate the owner's effect on companies' performance growth rates by using three methods:

a) First differences estimator (FD)

$$y_{it} - y_{it-1} = z_{it} - z_{it-1} + \beta(x_{it} - x_{it-1}) + e_{it} - e_{it-1} \quad (9)$$

and, after substituting, we obtain:

$$y_{it} - y_{it-1} = \alpha + \beta(x_{it} - x_{it-1}) + \gamma d_i + e_{it} - e_{it-1} \quad (10)$$

First differencing eliminates any time-invariant ownership effects on levels of productivity, but allows us to obtain estimates of effects of ownership on growth rates. The same is true of the within-transformation for the fixed effects estimator.

b) Within or fixed effect estimator (FE)

$$y_{it} - \bar{y}_i = z_{it} - \bar{z}_i + \beta(x_{it} - \bar{x}_i) + e_{it} - \bar{e}_i \quad (11)$$

and, after substituting, we obtain:

$$y_{it} - \bar{y}_i = \alpha t + \beta(x_{it} - \bar{x}_i) + \gamma d_i t + e_{it} - \bar{e}_i \quad (12)$$

c) Between estimator for differences (Long difference estimator)

$$\frac{y_{iT} - y_{i0}}{\tau} = \frac{z_{iT} - z_{i0}}{\tau} + \beta \frac{x_{iT} - x_{i0}}{\tau} + \frac{e_{iT} - e_{i0}}{\tau} \quad (13)$$

and, after substituting, we obtain:

$$\frac{y_{iT} - y_{i0}}{\tau} = \alpha + \beta \frac{x_{iT} - x_{i0}}{\tau} + \gamma d_i + \frac{e_{iT} - e_{i0}}{\tau} \quad (14)$$

Using between estimators once again we measure the impact on the average productivity growth.

First differences and fixed effect estimators are useful for dealing with the possible time invariant error correlation with the independent variables and are often used for this purpose in the literature. However, under the presence of significant measurement errors both fixed effect and first differences estimator are known to amplify this problem (Griliches and Hausman,1986). Mairesse and Jaumandreu (2005) have demonstrated that "errors in variables and other types of complex specification errors, which are not well taken into account by the IV (or GMM panel-data estimators and tend to be exacerbated in the time-series dimension of the data, generating larger biases in that dimension than in the cross-sectional dimension."

The between estimator, on the other hand, can reduce the effect of measurement errors. When applied to estimations in first differences, the between estimator is often referred as the long

difference estimator. Its ability to reduce the impact of errors in this case has an obvious explanation: the growth rate over several years is less noisy than the growth rate in one year.

The long differences method has been largely ignored in the relevant empirical literature. However its attractive features in the presence of measurement errors were shown by Griliches and Hausman (1984). Assuming a decreasing autocorrelation of the measurement errors, the authors have demonstrated that the, long differences estimator (LD) produces a smaller bias than the within estimator, which in turn is better than the first difference estimator: Bias of LD coefficient< Bias of FE coefficient < Bias of FD coefficient.

According to Griliches and Hausman (1986) if there is more than one explanatory variable subject to measurement errors "the formulas become more complex but can be similarly derived provided that these measurement errors are mutually uncorrelated", which seems to be realistic in this context. Below is the summary of Griliches and Hausman (1986) findings on the bias of different panel data estimators caused by the presence of measurement errors. The formulas derivations can be found in Griliches and Hausman (1984) .

Let the true equation be of the form:

$$y_{it} = \alpha_i + \beta\varphi_{it} + e_{it}, \qquad (15)$$

where α_i is the unobserved individual effect, e_{it} are standard i.i.d errors, however only x_{it}, the erroneous reflection of φ_{it}, can be observed. $\varphi_{it} = x_{it} + \xi_{it}$, where ξ_{it} is a measurement error with variance σ_ξ^2. If ρ_t is the serial correlation of the measurement error of order *t*, biases of the first difference, within and long difference estimators for the above model can be written in the following way

Table 16: Comparison of estimate biases

$p\lim b_d - \beta$	$p\lim b_w - \beta$	$p\lim b_j - \beta$
$-(\sigma_x^2 - \sigma_\varphi^2\rho_1)^{-1}\sigma_\xi^2\beta$	$-(\sigma_x^2 - \frac{2\sigma_\varphi^2}{T-1}\sum\frac{T-j}{T}\rho_j)^{-1}\sigma_\xi^2\beta$	$-(\sigma_\xi^2 + \sigma_\varphi^2(1-\rho_j))^{-1}\sigma_\xi^2\beta$
$-(\sigma x^2 - \sigma z^2\rho_1)^{-1}\sigma v^2\beta$	$-(\sigma x^2 - 2\sigma z^2/(T-1)\Sigma(T-j)/T\ \rho_j)^{-1}\sigma v^2\beta$	$-(\sigma v^2 + \sigma z^2(1-\rho_j))^{-1}\sigma v^2\beta$

Source: Griliches Z., Hausman J (1984)

The first difference estimator bias is higher than the bias of the within estimator for numbers of periods higher than two and provided the serial correlation is declining, that is if T>2

and $\frac{2}{T}(\rho_1 + \rho_2 + ...) < \rho_1$. However, if the time difference is more than one period the result will change. The long difference estimator is an OLS estimator on the data transformed in the following way: $d^j x = x_t - x_{t-j}$. For example if T=3 and j=2, the bias of the long difference estimator will be smaller than that of the within estimator as long as $\rho_1 > \rho_2$, i.e. under the same assumption of declining serial correlation of measurement errors. This assumption seems to be reasonable from an economic point of view. We take advantage of applying the LD estimator to highly noisy data.

3.4.3 Using instrumental variables

Khanna and Yusef (2005) studied the reasons behind the lack of literature consensus on business group impact and outlined several common methodological shortcomings that might be partially responsible for it. They identified endogeneity as one of the main shortcomings. There are multiple ways to address endogeneity: matching treated firms with otherwise similar non-treated firms (e.g. propensity score matching method), using fixed effects with trends with panel data before and after treatment, and use of instrumental variables.

Standard OLS estimation requires all independent variables to be uncorrelated with the error term in order for the coefficients to be consistent.

OLS: $b = \beta + (x'x)^{-1} x'u$ (16)

plim(b) = beta + plim((x'x)$^{-1}$)plim(x'u), where plim(x'x)-1 exists and plim(x'u)=0

However, economic priors cast doubt on the validity of this assumption for our data. The likelihood that the business group ownership itself is dependent on the initial company performance is high. For this reason we use instrumental variables method and check the robustness of our results with several statistical tests. We remind that an instrument variable is correlated with the estimator but not with the error term. Thus the instrumental variables method has two major assumptions: relevance $E(z'x) \neq 0$ and validity $E(z'u) = 0$. They should both be fulfilled for all instruments and controls to guarantee consistent coefficients estimations.

IV: $b = \beta + (zx)^{-1} z'u$ (17)

plim(b) = beta + plim((z'x)$^{-1}$)plim(z'u), where plim(z'x)-1 exists and plim(z'u)=0

At the first stage t-statistics of the instrument coefficients are used to asses their strength of identification along with the total F-statistics.

3.5 Business Group Effect on Performance: TFP in levels

We begin our analysis by estimating the total factor productivity function in levels controlling for the different types of owners including business groups. We aim to make our analysis robust with respect to several methodological and data problems. In order to minimise the sensitivity of the results to ad hoc assumptions we use different production function specifications. The estimations below follow the order described in the methodology section.

3.5.1 Cobb-Douglas production function

Table 17 contains the results of cross-section estimations of the Cobb–Douglas production function for five separate years 1999, 2000, 2001, 2002, 2003 and also for the pooled sample.

$$y_i = \alpha + \beta_1 k_i + \beta_2 l_i + \sum \gamma_k D_{ki} + u_i \qquad (18)$$

Table 17: Cross-section estimation of the TFP in levels for 1999, 2000, 2001, 2002, 2003 versus pooled OLS

	Pooled OLS	1999	2000	2001	2002	2003
K	0.187**	0.304**	0.291**	0.282**	0.303**	0.318**
	(0.023)	(0.047)	(0.043)	(0.039)	(0.036)	(0.043)
L	0.723**	0.786**	0.757**	0.743**	0.693**	0.673**
	(0.038)	(0.064)	(0.059)	(0.054)	(0.051)	(0.062)
Business groups	-0.330**	-0.213**	-0.307**	-0.376**	-0.289**	-0.244**
	(0.076)	(0.081)	(0.083)	(0.075)	(0.079)	(0.075)
Foreigners	0.416**	0.389**	0.349**	0.260*	0.242	0.404**
	(0.141)	(0.151)	(0.117)	(0.131)	(0.126)	(0.108)
Federal government	0.040	0.003	0.027	0.038	-0.026	0.036
	(0.121)	(0.124)	(0.133)	(0.122)	(0.124)	(0.132)
Regional government	-0.090	0.039	-0.079	-0.172	-0.331	-0.144
	(0.162)	(0.146)	(0.141)	(0.143)	(0.233)	(0.173)
Constant	4.676**	3.866**	4.461**	4.907**	5.101**	4.999**
	(0.532)	(0.286)	(0.301)	(0.283)	(0.318)	(0.342)
Num of obs	4775	948	1025	1068	934	909
R^2	0.86	0.87	0.87	0.88	0.88	0.88

Note: excluded ownership category is private, i.e unaffiliated, companies; 32 sector and 74 territory dummies are also included in all regressions, and pooled OLS contains year dummies.
Robust standard errors in parentheses * significant at 5%; ** significant at 1%

The output elasticity of capital and labour are stable in time with the capital coefficient following the upward trend from 0.304 in 1999 to 0.318 in 2003, and labour contribution declining from 0.786 to 0.673. Two other strong trends emerge in the cross-section estimations: the negative influence of business groups and positive impact of foreign owners on the total productivity level of their companies compared to private independently run firms. Business group companies have total productivity that is between 20 to 30 percent lower than that of unaffiliated companies. We

also estimate that foreign owned firms demonstrate a premium in performance that ranges from 25 to 40 percent. There can be two explanations for this outcome. The revealed inefficiency of business groups can be the outcome of substandard governance, e.g. resulting from higher control ownership gap, or it can be caused by more widespread tax evasion accounting practices. Similar factors, but acting from the other side of the spectre, including more transparent tax reporting and higher-quality corporate governance, can be responsible for the consistently significant positive coefficient for foreign companies. It is worth noting that the federal and regional government impact on the companies under their control is not significantly different from that of other private owners. Pooled OLS results reveal similar co dependencies. We also apply the "between" estimator so as to minimise the possible bias due to the error term correlation with some of the independent variables.

Table 18: Between and pooled OLS estimation of TFP in levels

	Pooled OLS	Between
K	0.187**	0.276**
	(0.023)	(0.024)
L	0.723**	0.751**
	(0.038)	(0.032)
Business groups	-0.330**	-0.290**
	(0.076)	(0.071)
Foreigners	0.416**	0.372**
	(0.141)	(0.141)
Federal government	0.040	-0.003
	(0.121)	(0.119)
Regional government	-0.090	-0.079
	(0.162)	(0.137)
constant	4.676**	3.230**
	(0.532)	(0.964)
Num of obs	4775	1207
R^2	0.86	0.87

Note: 32 sector and 74 territory dummies are also included in all regressions, Robust standard errors in parentheses * significant at 5%; ** significant at 1%

Between estimator gives similar results: a negative impact of business group ownership and a positive influence of foreign ownership. The impact of federal and regional government ownership is undistinguishable from other private owners. The standard OLS procedure with dummy variables tests the effect of each owner in comparison to the benchmark group – private independent owners in our case. In order to compare owners' impacts between different types of owners we use the F-test of the null hypothesis that $b(owner\_i)-b(owner\_j)=0$. Table 19 reports values for F-statistics and corresponding p-values for the comparison between all types of owners in the year 2003 cross-section. Test results for other years and pooled OLS equations reveal similar regularities and thus are not reported.

Table 19: Testing difference in coefficients

Absolute difference/ F-test	Foreigners	Federal government	Regional government
Business groups	29.03	4.78	0.32
	(0.00)	(0.029)	(0.574)
Foreigners	-	4.99	7.42
		(0.258)	(0.006)
Federal government		-	0.93
			(0.334)
Test k+l=1	0.07		
	(0.798)		

Note: F(1,797) reported; Prob>F in brackets

As predicted, foreign owners' impact is significantly different from most of other owners whereas federal and regional government have the same effect. Interestingly, we can not reject the hypothesis that business groups and regional governments have statistically different impacts. The results reported in the last row show that one can not decline the hypothesis that the production function is characterised by constant returns to scale.

The revealed relationships can have several explanations. The first one assumes that our model specification and estimation assumptions are correct, and indicates that business groups indeed mismanage their companies and have a negative impact on their level of productivity. A second explanation may lie in a misspecification of the model resulting in biased estimations. One possible source of such misspecifications can be the use of linear functions to model significantly nonlinear production behaviours. Indeed if the average capital to labour ratio varies with the owner type, the owner dummy variables may absorb such nonlinearities, and the standard Cobb-Duglas function estimation will produce biased coefficients. A third explanation comes from the application of econometric methods requiring inappropriate assumptions on data. Possible problems include endogeneity or measurement errors. If business groups were initially buying underperforming companies, these econometric results would be explained but it would however result in incorrect conclusions. As a consequence, we seek to test these explanations and include an additional robustness check by testing our results against the ones obtained by Guriev and Rachinsky (2005).

3.5.2 Comparing results with Guriev and Rachinsky (2005)

In their study of the oligarchs' impact Guriev and Rachinsky (2005) estimate level and growth TFP equations. Their cross-section estimation of the total factor productivity level on 2001 and 2002 data concluded to a negative but insignificant impact. We investigate the source and

significance of the divergence from our results by replicating their estimations. Table 20 contains the output of cross-section estimations using the data and ownership classification as in Guriev and Rachinsky (2005). Model specifications are the same as in Table 17, i.e. a loglinear Cobb-Douglas production function with capital and labour as production factors.

Table 20: Cross-section estimation of TFP in levels: Guriev ' and Rachinsky's data

	1999	2000	2001	2002	2003
K	0.280***	0.296***	0.316***	0.380***	0.368***
	0.043	0.041	0.044	0.044	0.044
L	0.642***	0.569***	0.599***	0.506***	0.538***
	0.068	0.064	0.059	0.060	0.062
Business groups	-0.006	-0.187*	-0.183*	-0.145	-0.142
	0.096	0.084	0.089	0.088	0.081
Foreigners	0.216	0.157	0.153	0.205	0.372**
	0.130	0.112	0.157	0.141	0.135
Federal government	0.244	0.261	0.366*	0.134	0.064
	0.161	0.143	0.168	0.181	0.179
Regional government	0.051	0.075	0.073	0.078	0.082
	0.187	0.140	0.139	0.158	0.168
Const	4.601***	5.209***	5.183***	4.733***	4.853***
	(0.33)	(0.34)	(0.33)	(0.35)	(0.36)
Num of obs	802	989	921	921	851
R^2	0.86	0.85	0.86	0.88	0.87

Note: 32 sector and 74 territory dummies are also included in all regressions, Robust standard errors in parentheses * significant at 5%; ** significant at 1%

The overall results are similar to our estimations in terms of direction of owner's impact, but there are small differences in the magnitude of coefficients and their significance levels. Business groups still have a negative impact on the productivity level, with significant results in two out of five cross-sections. Possible sources of this divergence are 1) a different treatment of outliers and data cleaning techniques 2) a slight difference in owners' classification in cases when control is shared 50/50. Note that the classification of companies according to their main owner type coincides in 90% of cases.

In order to estimate the significance of these differences for the ownership coefficients their covariance matrix is required. To this end we create the combined dataset, by stacking two datasets together. Before that all the variables in our dataset are renamed with an additional suffix *1*. The explanatory variables in the Guriev's dataset receive corresponding suffix *2*. When stacking the datasets together we substitute values for independent variables from the other dataset with zero. We deal with the correlation of error terms for the same observations in two

dataset by using *clusters*. Clusters are formed by the variable that contains a unique number for each company. Under the specification of "cluster-robust" covariance matrix estimation procedure allows for arbitrary within-cluster correlation, which we have to account for because the cluster members are two observations on the same firm, one used for our estimation and one used for the Guriev and Rachinsky estimation. This allows us to estimate the covariance matrix needed to test the comparability of the coefficients.

$$y = \alpha + \beta_1 k1 + \beta_2 l1 + \sum d_k D1_{ki} + \sum e_k X1_{ki} + \beta_3 k2 + \beta_4 l2 + \sum c_k D2_{ki} + \sum f_k X2_{ki} + u_i \quad (19)$$

Table 21: Testing difference in coefficients for two samples

Guriev's sample Our results	k 2003	l 2003	Business groups	Foreigners	Federal government	Regional government
k 2003	3.17					
l 2003		1.43				
Business groups			0.01			
Foreigners				0.91		
Federal government					0.14	
Regional government						1.91

Note: F-stat reported

Table 21 contains F-statistics for the null hypotheses that *b*(*owner_i*)-*b*(*owner_j*)=0. It shows that we can not reject the hypothesis of equality between ownership coefficients in our and Guriev's estimations. The conclusions of these statistical tests are that comparison of our results is justified.

To identify which of the two differences in estimations, data cleaning method or owners classification, is responsible for the divergence in ours and Guriev and Rachinsky's findings regarding the significance of the ownership coefficient, we estimated two additional regression sets: 1) with our owners classification and Guriev and Rachinsky's method of removing extreme 1% of variables distribution 2) using our data cleaning method and their owners' classification. Our findings show that data cleaning method is the main reason why we get significant negative impact and Guriev and Rachinsky get an insignificant negative impact.

3.5.3 Alternative functional forms: owner-specific and translog.

Although the most widespread production function due to its practicality, the log linear Cobb-Douglas production function can become a source of errors in some cases. In our study these errors may appear for two reasons. 1) Different production functions for different owner types.

This can be justified by the concentration of business groups in specific industries. 2) A variation in output elasticity to labour and capital combined with significant differences in capital and labour depending on the owner type. We address these vulnerabilities by estimating a) owner-specific production functions and b) translog production function. Economic rationale favours the latter option. Indeed, it is more intuitive for output elasticity coefficients to depend on levels of capital and labour.

We begin with estimating owner-specific production functions that allow different capital and labour coefficients for different owner types. We change the estimated production function by replacing capital and labour with their cross-products with the owner type dummy variables.

$$y = \alpha + \sum \beta kX + \sum \gamma lX + \sum dkDk_i + \sum akXk_i + u \qquad (20)$$

Consequently, we test whether the capital and labour coefficients are significantly different for different owners. We report the corresponding F-tests statistics in the Table 22, Table 23 and Table 24.

Table 22: Testing the equality of capital elasticity coefficients

	Business groups	Foreigners	Federal government	Regional government	Private
Coefficient	0.353**	0.478**	0.175*	0.645*	0.237**
	(0.057)	(0.085)	(0.070)	(0.253)	(0.053)
Business groups	-	1.647	4.557*	1.396	2.801
		0.200	0.0331	0.238	0.0946
Foreigners		-	8.211**	0.414	7.193**
			0.00427	0.520	0.00747
Federal government			-	3.272	0.555
				0.0709	0.456
Regional government				-	2.664
					0.103

Note: F-stat reported; Prob>F below

Table 23: Testing the equality of labour elasticity coefficients

C	Business groups	Foreigners	Federal government	Regional government	Private
Coefficient	0.697**	0.376**	0.486**	0.423	0.691**
	(0.096)	(0.119)	(0.097)	(0.286)	(0.087)
Business groups	-	5.110*	2.588	0.909	0.00303
		0.0241	0.108	0.341	0.956
Foreigners		-	0.507	0.0234	5.536*
			0.477	0.878	0.0189
Federal government			-	0.0441	2.471
				0.834	0.116
Regional government				-	0.883
					0.348

Note: F-stat reported; Prob>F below

Table 24: Joint test of differences in capital and labour elasticities

	Foreigners	Federal government	Regional government	Private
Business groups	2.555	12.69***	0.892	5.958**
	0.0783	0.000	0.410	0.00270
Foreigners		4.436*	1.513	4.352*
		0.0121	0.221	0.0132
Federal government			10.67***	4.968**
			0.000	0.00717
Regional government				3.627*
				0.0270

Note: Ho: $k_i=k_j$ and $l_i=l_j$; F-stat reported; Prob>F below

The above results indicate that there is not sufficient evidence to believe that business group companies have a unique production function. It is worth noting that the production function of federal state owned companies is different from that of other owners and has diminishing returns to scale. At this point we can conclude that the negative effect of business groups on their companies does not derive from owner-specific production functions.

However, there are some differences in average sample statistics of labour and capital for different owners. Table 25 contains the results of OLS regressions on the set of owner dummy variables for capital, labour, capital labour ratio and labour productivity.

Table 25: Testing sample differences in capital, labour, capital intensity and labour productivity in 2003 (controlling for industry and region)

	k	L	k/l	y/l
Business groups	-0.225	-0.269*	0.044	-0.228**
	(0.170)	(0.123)	(0.097)	(0.078)
Foreigners	0.646**	-0.150	0.796**	0.658**
	(0.211)	(0.140)	(0.179)	(0.145)
Federal government	0.130	0.163	-0.033	0.023
	(0.278)	(0.203)	(0.164)	(0.132)
Regional government	-0.108	0.101	-0.208	-0.215
	(0.281)	(0.207)	(0.196)	(0.161)
Constant	13.129**	7.195**	5.934**	6.794**
	(0.431)	(0.270)	(0.222)	(0.179)
Num of obs	909	909	909	909
R^2	0.52	0.43	0.54	0.56

Note: 32 sector and 74 territory dummies are also included in all regressions, Robust standard errors in parentheses * significant at 5%; ** significant at 1%

Foreign owned companies have the highest capital labour ratio and labour productivity levels. If we assume that the true production function is increasing with capital intensity, this sample difference can be the reason for the superior performance of foreign owned companies.

It is important to remember that transfer pricing, underreporting revenues and undervalued capital for the purpose of tax evasion are not uncommon among Russian companies. These activities can introduce a general downward bias in the capital and output variables of domestic firms. In opposition, employment data is in practice more reliable. If the magnitude of underreporting is not correlated with the type of owner, our results will still be valid. However, as the transition literature often indicates, foreign owners often have better corporate ethics and less tax-evasion activities. This probably contributes to the higher capital and productivity indicators of foreign owned companies.

We observe that business group owned companies have lower labour levels on average. Note also that a varying output to labour elasticity may result in biased estimates. However part of the sample differences are absorbed by industry dummies. Table 26 shows estimations without controlling for the industry or regional dummy variables. Without controlling for industry specificity both federal and regional companies are larger than privately owned ones. In conclusion the higher capital to labour ratio of business group owned companies, together with their lower labour productivity, point toward either underperformance or underreporting.

Table 26: Testing sample differences in capital, labour, capital intensity and labour productivity in 2003 (not accounting for sector or region)

	K	L	k/l	y/l
Business groups	0.218	-0.007	0.224*	-0.252**
	(0.168)	(0.115)	(0.098)	(0.080)
Foreigners	0.921**	-0.372**	1.294**	1.216**
	(0.207)	(0.134)	(0.184)	(0.151)
Federal government	2.065**	0.765**	1.300**	0.777**
	(0.262)	(0.165)	(0.154)	(0.126)
Regional government	0.880**	0.487*	0.394*	0.048
	(0.281)	(0.207)	(0.196)	(0.161)
Constant	12.369**	6.772**	5.597**	6.502**
	(0.103)	(0.067)	(0.071)	(0.058)
Num of obs	909	909	909	909
R^2	0.07	0.03	0.11	0.14

Note: Robust standard errors in parentheses * significant at 5%; ** significant at 1%

We use translog specification of the production function to account for possible nonlinearities and varying elasticities. The higher flexibility of the translog function compared to the standard Cobb-Douglas should help incorporating the impact of sample differences.

$$y = \beta_0 + \beta_1 k + \beta_3 (k * l) + \beta_4 (k)2 + \beta_5 (l)2 + \sum dkDk_i + \sum akXk_i + u \qquad (21)$$

Table 27: Estimation of translog production function

	1999	2000	2001	2002	2003
k	0.177	0.333*	0.217	0.580***	0.148
	(0.23)	(0.17)	(0.18)	(0.18)	(0.18)
l	1.402***	1.190***	1.377***	0.940***	1.323***
	(0.27)	(0.23)	(0.23)	(0.27)	(0.29)
k^2	0.0503***	0.0358***	0.0459***	0.0226**	0.0471***
	(0.014)	(0.011)	(0.0096)	(0.0093)	(0.0093)
l^2	0.104***	0.0928***	0.101***	0.102***	0.104***
	(0.026)	(0.028)	(0.020)	(0.023)	(0.027)
k*l	-0.164***	-0.137***	-0.159***	-0.127***	-0.157***
	(0.029)	(0.028)	(0.020)	(0.017)	(0.021)
Business groups	-0.182**	-0.268***	-0.350***	-0.252***	-0.199***
	(0.080)	(0.083)	(0.075)	(0.078)	(0.073)
Foreigners	0.366**	0.314***	0.206	0.216*	0.400***
	(0.15)	(0.12)	(0.13)	(0.12)	(0.10)
Federal government	0.0560	0.0301	0.0182	-0.0508	0.0154
	(0.12)	(0.13)	(0.12)	(0.12)	(0.13)
Regional government	0.0451	-0.0750	-0.152	-0.323	-0.117
	(0.14)	(0.14)	(0.14)	(0.23)	(0.17)
Constant	2.512**	2.740***	3.136***	2.571***	3.882***
	(1.12)	(0.94)	(0.88)	(0.70)	(0.64)
Num of obs	948	1025	1068	934	909
R^2	0.88	0.88	0.88	0.89	0.89
K elasticity	0.350	0.322	0.312	0.296	0.278
L elasticity	0.709	0.696	0.704	0.696	0.741

Table 27 shows that the change of functional form did not alter the results of negative and positive impact of business group and foreign ownership respectively. The average capital and labour elasticities are consistent with the Cobb-Douglas function estimations. Thus we conclude that, independently of the production function specification, business group companies underperform compared with privately owned companies in terms of total factor productivity level. The negative impact of business group ownership on the total factor productivity is significant and independent of regional differences. The next section investigates whether this result could be driven by the fact that the initial privatisation process led to business groups acquiring more poorly performing firms.

We note that the capital coefficient becomes much less significant and more variable under the translog function. We estimate translog function on a larger set of data from the Goskomstat survey dataset, without accounting for the ownership type, to find more robust coefficients estimate. By having a larger number of explanatory variables, translog specification uses up the degrees of freedom and for this reason it is better suited for larger samples. Given that our main research question is to determine the impact of business groups on company performance, we will continue to use the log linear specification in further estimations.

3.5.4 Using instruments to address possible endogeneity of ownership

Endogeneity is one of the major methodological concerns in the literature studying the effect of ownership on companies' performance. If the previous performance indicators of firms had influenced the choice of the owner, the current TFP coefficients would be biased. We will use instrumental variables in order to address this problem. A good instrument is a variable that is correlated with the endogenous explanatory variable but is not correlated with the error term. Finding proper instruments is the most demanding part of this method of model estimation. They do not always exist for a particular model, and even when they do exist there is often a problem with data availability

Business groups can acquire companies depending on their characteristics that might be correlated with the performance indicators. If this is the case our model will suffer from the endogeneity problem. E.g. if business groups were buying underperforming companies, we could observe a negative correlation between the productivity levels and "being part of a business group" even in the situation where business group affiliation has a positive effect on performance.

The possible solution to this problem consists in finding an instrumental variable for the business group ownership, i.e. a company characteristic that influenced the owner choice but not the productivity of the company in the analysed period. The business groups in Russia have largely expended their acquisitions after the loans-for-shares auctions in 1996. Assuming that all companies were independent before 1994, we can choose our instruments among the characteristics of firms in 1994. We also run robustness checks by using 1995 and 1996 variables.

We limit our instrument variables analysis to two types of owners for the consideration of avoiding the increased complexity of the model estimation. For our main question of interest is the impact of business groups on the performance of their companies. Thus we run estimations for a limited sample of business groups versus other privately owned companies.

With the aim of finding an appropriate instrument for the ownership variable we estimate the relationship between business group ownership and companies' performance indicators in 1994, 1995 and 1996 as well as their average growth over 1994-1996. Table 28 contains the coefficients and standard errors of corresponding logit regressions. $prob(bg = 1) = f(x)$, where

x is replaced with one of the variables in the top row of the table in a particular year, listed in the left column.

Table 28: Coefficients of one-factor logit regressions with business group ownership as dependent variable

	y	k	l	y/k	y/l	k/l
1994	0.121***	0.218***	0.240***	-0.398***	-0.0560	0.358***
	(0.045)	(0.045)	(0.061)	(0.081)	(0.076)	(0.091)
1995	0.0980**	0.246***	0.232***	-0.370***	-0.0668	0.428***
	(0.042)	(0.046)	(0.060)	(0.084)	(0.075)	(0.094)
1996	0.0675*	0.266***	0.293***	-0.268***	-0.0627	0.382***
	(0.040)	(0.053)	(0.064)		(0.079)	(0.11)
average growth rate 1996-1994	-0.291	0.399	-0.145	-0.00760	-0.201	
	(0.28)	(0.57)	(0.70)	(0.23)	(0.29)	

The results presented above indicate that business groups were acquiring larger companies with higher capital to labour ratios. The companies that are owned by business groups in 2003 tend to have lower returns on capital in 1994-1996. Labour productivity level before 1996 does not influence the probability of being part of business group; neither do the sales or revenue to capital growth rates.

Among the above variables that are highly correlated with the probability of being part of the business group in 2003, the sales to capital ratio for 1994-96 has the lowest autocorrelation over time. This does not guarantee it is a good instrument, because it could still be correlated with the error term in the performance equation. However, these concerns are greater for the other candidate variables which have changed less over time. Therefore we use the sales/capital ratio to instrument business group ownership rather than level of capital or the capital/labour.

Table 29: 2SLS estimation results: accounting for the endogeneity

2003	2001	2002	2003	2003
k	0.620***	0.647***	0.606***	0.424***
	(0.15)	(0.13)	(0.15)	(0.041)
l	0.630***	0.539***	0.710***	0.617***
	(0.17)	(0.17)	(0.20)	(0.061)
Business groups	-5.165***	-4.779***	-5.097**	-0.191**
	(1.45)	(1.55)	(2.29)	(0.083)
	F(1,460)	F(1,403)	F(1,381)	
Anderson-Rubin test	69.20	49.36	59.64	
p-value	0.000	0.000	0.000	
Constant	5.861***	5.416***	4.199***	3.712***
	(1.10)	(1.18)	(1.62)	(0.30)

F-stat, first stage	9.15	7.02	3.87	
Instrument:				
y/k 1994	-0.0723***	-0.0676***	-0.0516**	
	(0.0239)	(0.0255)	(0.0262)	
Number obs	531	470	450	450

Note: last column contains 2003 estimations without instrumental variables on the reduced sample for comparison purposes

Table 29 contains the results of two-stage least squares estimation of the business group impact on the total productivity levels. We estimate regressions on 2001, 2002 and 2003 cross-section data. First column contains results of the one stage OLS estimation for 2003 on sample, limited to companies for which information on sales and capital in 1994 is available. This allows us to distinguish between the changes in our results due to differences in samples versus changes induced by the use of instrument variable for business group ownership.

Low values of the first-stage F-statistics in all the equations indicate that we have a problem of "weak instruments", i.e. low correlation of instrument variable with endogenous regressor. This undermines the reported statistical significance of the business group coefficient. As noted by Staiger and Stock (1997) if the value of the first-stage F-statistics is small, standard asymptotic approximations to the distributions of the instrumental variables statistics lose their validity, even for large samples. Stock and Yogo (2002) have tabulated critical values for Craig-Donald statistics (F-statistics in case of single endogenous variable) for weak instrument test. For our case of a single instrument it equals 16.38 for 10% maximal size of bias. In all the equations F-statistics is smaller than Stock-Yogo critical value for weak instrument test. This means that we can not rely on the standard t-test to estimate the significance of business group ownership.

To address this problem we use the Anderson-Rubin test of the significance of the endogenous regressors as discussed by Baum, Schaffer and Stillman (2007). Anderson-Rubin test reported in Table 29 is estimated using *ivreg2* command, coded by Baum, Schaffer and Stillman (2007) for *Stata*. The null hypothesis is that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero. The main advantage of this test is that it is robust in the presence of weak instruments. High values of Anderson-Rubin test of the significance of the endogenous regressors show that coefficient on business group in the structural equation is significant, and, consequently, that the business groups' negative effect on the level of companies productivity persist even after accounting for the endogeneity problem.

Negative correlation of the business group ownership variable with the returns on capital (y/k) in 1994 is probably explained by the fact that business groups were mostly interested in the companies in metallurgical, oil, and other capital-intense industries. Anecdotal evidence from that time suggests that the market value of the assets of these companies was often highly undervalued, making them more attractive as acquisition targets for business groups.

3.6 Business Group Effect on Growth: TFP in growth rates

In this section we study the effect of the different types of owners on the growth rates of their companies' productivity. Guriev and Rachinsky (2005) showed that oligarchs' ownership increases the total factor productivity growth of their companies by an average 8 percent difference over other private owners. The authors estimated cross-section regression for 2001-2002 growth. Since Russian company data are prone to high measurement error levels, first differences transformation of these data known to augment the level of such errors. For these reasons the single year growth rate estimation is a vulnerable measure and requires additional robustness checks.

3.6.1 Estimating productivity growth rates

We estimate the total factor productivity growth for four years: 1999-2000, 2000-2001, 2001-2002 and 2002-2003. As our ownership data is only available at one point of time – the summer of 2003, the last cross-section is less prone to measurement errors in the ownership variable. We also run an estimation on the pooled dataset for all four years, including *between* estimate. The *between* estimate for the pooled dataset of growth rates is in fact a long difference estimate. Long difference estimates were shown by Griliches and Hausman (1984) to reduce the measurement error impact on the coefficients. Their result has an intuitive explanation: each measurement error in the single year growth rate is averaged out and thus its effect on the performance indicator is reduced.

Table 30 contains results of the Cobb-Douglas production function estimations for a single year growth rates from 1999 to 2003.

$$dy = \beta_0 + \beta_1 dk + \beta_2 dl + \sum dkDk_i + \sum akXk_i + u \qquad (22)$$

Table 30: Estimating Total Factor Productivity in growth rates

	1999-2000	2000-2001	2001-2002	2002-2003
Δk	0.132**	0.0448	0.0767	0.120**
	(0.056)	(0.031)	(0.070)	(0.049)
Δl	0.726***	0.691***	0.685***	0.602***
	(0.11)	(0.10)	(0.084)	(0.087)
Business groups	-0.0512	-0.0338	0.0983**	0.0538
	(0.041)	(0.034)	(0.042)	(0.033)
Foreigners	0.183*	-0.153	0.0449	0.149
	(0.097)	(0.11)	(0.056)	(0.091)
Federal government	0.0953	-0.0913*	-0.0109	-0.0783
	(0.081)	(0.050)	(0.065)	(0.061)
Regional government	0.0419	-0.0739	-0.160	-0.0761
	(0.077)	(0.062)	(0.11)	(0.074)
Const	0.325***	0.0565	-0.105	0.0298
	(0.076)	(0.093)	(0.094)	(0.074)
Num of obs	1028	1047	959	887
R2	0.27	0.30	0.53	0.50

The business group impact on companies' productivity growth is significantly positive only for 2001-2002. For other years, including the years 2002-2003 which contain lower probability of owner miscoding, the impact is insignificant In addition high standard errors of the capital coefficients point to the high noise content in the single year growth data. We run regressions on the pooled dataset of growth rates and use the *between* estimation. Results reported in Table 31 show improved capital coefficient significance and confirm the conclusion of insignificant impact of business group ownership on the productivity growth.

Table 31: Estimating Total Factor Productivity in growth rates: between estimate

	Panel	Between
Δk	0.113***	0.132***
	(0.031)	(0.026)
Δl	0.273***	0.258***
	(0.038)	(0.032)
Business groups	-0.0206	-0.0108
	(0.022)	(0.026)
Foreigners	0.00350	-0.0161
	(0.053)	(0.050)
Federal government	-0.0338	-0.0375
	(0.039)	(0.043)
Regional government	-0.0240	-0.0323
	(0.044)	(0.051)
Const	0.221	0.00611
	(0.22)	(0.31)
Num of obs	4554	1182
R^2	0.09	0.2

The *between* estimate is an OLS estimation of the average growth rates for 1999-2003. As an additional robustness check we estimate several long difference growth rates. It is worth noting that longer difference estimates all have significant capital coefficients. This provides additional evidence for the Griliches and Hausman (1984) finding that long difference estimates reduce the impact of the measurement error in comparison with the first difference estimates.

Table 32: Estimating TFP in growth rate: long differences

	1999-2001	1999-2002	1999-2003	2000-2002	2000-2003	2001-2003
Δk	0.183***	0.164***	0.190***	0.131***	0.176***	0.244***
	(0.040)	(0.043)	(0.042)	(0.048)	(0.046)	(0.055)
Δl	0.505***	0.539***	0.550***	0.412***	0.565***	0.494***
	(0.072)	(0.088)	(0.070)	(0.12)	(0.080)	(0.073)
Business groups	-0.125***	-0.0264	-0.0297	0.0596	0.00571	0.0880*
	(0.046)	(0.065)	(0.065)	(0.057)	(0.057)	(0.047)
Foreigners	0.184**	0.0569	0.262**	-0.0285	0.0415	0.103
	(0.087)	(0.15)	(0.11)	(0.10)	(0.084)	(0.080)
Federal government	-0.0290	-0.00748	-0.168	-0.0777	-0.226***	-0.134*
	(0.085)	(0.12)	(0.11)	(0.097)	(0.087)	(0.080)
Regional government	-0.0316	-0.167	-0.0507	-0.186	-0.0868	-0.0567
	(0.073)	(0.21)	(0.14)	(0.17)	(0.12)	(0.10)
Constant	0.475***	0.481***	0.582***	0.119	0.214*	-0.00633
	(0.100)	(0.12)	(0.13)	(0.12)	(0.12)	(0.10)
Num of obs	993	865	877	922	922	973
R^2	0.34	0.57	0.41	0.59	0.38	0.35

Once again, we do not see any statistically significant pattern of the business group effect on the productivity growth of their companies (as compared to the estimates of the negative effect of their level). The business group coefficient is negative and significant in one regression, positive and significant in the other. Foreign ownership is positive and significant in two regressions, while the federal government has a significantly negative impact on its companies' productivity growth.

3.6.2 Comparing first difference and long difference estimates

To compare the difference in the coefficients of the first differences versus long differences growth estimations we generate a combined dataset by stacking two samples. First we append four sets of annual growth variables including years 1999 to 2003, then we apply the same method as in 3.5.2. Table 33 contains F-statistics and corresponding p-values of tests for the equality of the pooled first differences coefficients and the long difference estimates.

Table 33: F-test for the equality of the coefficients as estimated by the first differences versus long differences estimations.

Long differences		Δk	Δl	Business groups	For.	Federal gov.	Regional gov.
First differences		0.182***	0.573***	-0.0576	0.362**	-0.144	-0.0839
		(0.057)	(0.11)	(0.085)	(0.15)	(0.13)	(0.19)
Δk	0.573***	0.233					
	(0.11)	0.629					
Δl	0.383***		4.293				
	(0.057)		0.0385				
Business	-0.0199			0.297			
groups	(0.022)			0.586			
	0.0614				5.821		
Foreigners	(0.046)				0.0160		
Federal	-0.0457					0.823	
government	(0.033)					0.364	
Regional	-0.0526						0.0365
government	(0.046)						0.849

Note: first row contains coefficient values as estimated by the long differences equation, first column contains coefficient values as estimated by the first differences equation. Table diagonal contains the values of F-stat for the equality of correspondent coefficients.

There is no significant difference in magnitude and sign of the ownership effect, however long differences estimation produce statistically significant positive coefficients for foreign owners and significantly negative coefficients for the federal government owned firms.

3.6.3 Capital coefficient sensitivity test to the measurement noise

In all the previous productivity growth rate estimations elasticity to capital change is much more volatile than elasticity to changes in employment. The reason behind it is a higher noise content in measuring capital variable (assets) in the Russian firms level data. To minimise the effect of measurement error in assets variables on our estimations we conduct several sensitivity tests by estimating production function with the exogenously fixed output capital elasticity to capital. We use three values that are in the range of previously estimated capital coefficient: 0.2, 0.15 and 0.1.

Table 34: Estimating TFP with constant capital coefficient: alpha= 0.2

	1999-2000	2000-2001	2001-2002	2002-2003
Δk*	0.2	0.2	0.2	0.2
Δl	0.428***	0.291**	0.259***	0.544***
	(0.15)	(0.13)	(0.081)	(0.082)
Business groups	-0.0761**	-0.0505	0.0671*	0.0361
	(0.037)	(0.036)	(0.036)	(0.027)
Foreigners	0.0514	-0.0857	0.0657	0.0456
	(0.066)	(0.11)	(0.058)	(0.047)
Federal government	-0.0715	-0.0490	-0.0358	-0.0358
	(0.061)	(0.054)	(0.054)	(0.049)
Regional government	-0.0297	-0.0747	-0.0579	-0.0273
	(0.079)	(0.064)	(0.096)	(0.062)
Const	0.426***	0.0561	-0.0138	0.0201

	(0.073)	(0.090)	(0.091)	(0.066)
Num of obs	880	948	889	809
R^2	0.26	0.22	0.20	0.27

Table 35: Estimating TFP with constant capital coefficient: alpha=0.15

	1999-2000	2000-2001	2001-2002	2002-2003
Δk*	0.15	0.15	0.15	0.15
Δl	0.435***	0.302**	0.266***	0.555***
	(0.15)	(0.13)	(0.083)	(0.082)
Business groups	-0.0786**	-0.0533	0.0674*	0.0345
	(0.037)	(0.036)	(0.036)	(0.027)
Foreigners	0.0537	-0.0861	0.0641	0.0440
	(0.065)	(0.11)	(0.058)	(0.047)
Federal government	-0.0726	-0.0510	-0.0351	-0.0388
	(0.061)	(0.054)	(0.053)	(0.049)
Regional government	-0.0315	-0.0774	-0.0604	-0.0297
	(0.079)	(0.065)	(0.097)	(0.062)
Const	0.440***	0.0647	-0.00128	0.0333
	(0.073)	(0.090)	(0.090)	(0.067)
Num of obs	880	948	889	809
R^2	0.26	0.22	0.20	0.27

Table 36: Estimating TFP with constant capital coefficient: alpha=0.1

	1999-2000	2000-2001	2001-2002	2002-2003
Δk*	0.1	0.1	0.1	0.1
Δl	0.443***	0.313**	0.273***	0.566***
	(0.15)	(0.13)	(0.085)	(0.082)
Business groups	-0.0811**	-0.0561	0.0677*	0.0328
	(0.037)	(0.036)	(0.036)	(0.027)
Foreigners	0.0561	-0.0866	0.0626	0.0425
	(0.065)	(0.11)	(0.058)	(0.047)
Federal government	-0.0736	-0.0531	-0.0344	-0.0418
	(0.061)	(0.054)	(0.053)	(0.049)
Regional government	-0.0332	-0.0800	-0.0629	-0.0321
	(0.079)	(0.065)	(0.097)	(0.062)
Const	0.453***	0.0734	0.0112	0.0465
	(0.072)	(0.089)	(0.088)	(0.067)
Num of obs	880	948	889	809
R^2	0.26	0.22	0.20	0.28

Estimation results in tables 34-36, with the fixed output growth elasticity to capital confirm the previous findings: a significant business group ownership effect for a single year in 2002 and insignificant or negative for other years. Other owner types do not have significant effect on the productivity growth of their companies.

3.7 Conclusion

We have performed a standard estimation of the impact of business groups on the total factor productivity of their companies using the Cobb-Douglas production function. This analysis reveals that business group owned companies significantly underperform compared with unaffiliated companies. We show that this outcome remains valid when 1) pooled OLS or *between* estimations are employed; 2) an increased flexibility of the production function specification is implemented; 3) we address the possible endogeneity problem with instrumenting business group ownership. We also observe that the production function is invariant relative to the owner type.

After robust analysis of data over several years we find no evidence of any significant business group ownership influence on the productivity growth rates of their affiliated companies. Our conclusion differs from the one reported by Guriev and Rachinsky (2003) based on the 2001-2002 growth data. We have extended their empirical analysis in several directions: 1) by studying additional time periods, including 2002-2003 for which the ownership data is more accurate; 2) by applying long difference estimator that is less sensitive to the measurement error bias; 3) by using fixed elasticity of output to capital in order to reduce the impact of the measurement error, largely present in our capital proxy variable. Use of the different estimation methods with the emphasis on addressing the main problem of Russian statistical data – high content of measurement error, makes our results more robust and valid.

In agreement with previous studies, we find strong evidence that foreign ownership has a positive effect on companies' performance. This conclusion is robust to the majority of specifications. The evidence regarding the federal government ownership influence on its companies is less strong. However, its downside impact prevails. On the other hand regional governments demonstrate a similar effect to that of business groups regarding several specifications.

Finally, our results confirm the findings of Griliches and Hausman (1984) that long difference estimates in the presence of measurement errors, give more robust coefficients. E.g. output elasticity to capital coefficients become significant when estimating long difference equations compared to the single year growth equations that amplify the measurement error effects.

Chapter 4 Market Structure Evolution in Russia

4.1 Motivation and literature review

Studying market structure dynamics in transition economies has a special interest for industrial organization economists. Transition economies provide highly valuable data on market structure dynamics that satisfies the conditions of the "natural" experiment due to the fact that initial industrial structures were exogenously determined by the state. Indeed the Russian market structure provides the unique opportunity to conduct empirical tests free from endogeneity problems. In this chapter we assess the validity of the John Sutton's (1991) market structure theory for the evolution of Russian industries.

Several theoretical paradigms were developed to study market structure formation and its impact starting from the Structure–Conduct-Performance paradigm and moving towards more complicated game theoretical models involving multi-period strategic behaviour of rival firms. The empirical results produced by the Structure–Conduct-Performance were largely criticized for being more of a "descriptive statistics rather than a causal relationship" (Tirole, 1988). Caves (2007), however, argued that the contribution of this field of industrial organization should not be underestimated, as it has established a large number of empirical regularities, which have motivated the development of more complex models.

One of the major concerns with the empirical tests of the latest models is the trade-off between the accuracy of the model and the generality of its application. Models with good predicting accuracy are usually very industry specific. This argument forms the basis for the opinion that general economic laws can not be applied to build a cross-industry model. John Sutton received wide recognition and was highly praised for overcoming this drawback. In 1991 he developed a cross-industry model (Sutton 1991) that provides empirically testable and significant predictions of market concentration levels. Sutton's model builds on the joint work with Avner Shaked (1987) on the impact of product differentiation on industrial structure. The model is based on the analysis of the interaction between two key factors: pattern of technology, i.e. relative size of sunk costs, and tastes, i.e. elasticity of demand to advertisement.

The model predicts that for industries with exogenous, technology dependent, sunk costs, market concentration should decrease with market size. However, for industries with endogenous sunk

costs, this relationship does not hold. A detailed description of this model is presented in the next section.

In spite of the concise and testable outcomes of Sutton's model, there is limited empirical research to validate it. However the few related studies provide supporting evidence for Sutton's theoretical predictions. The large part of the literature, however, is narrowly focused on specific industries in specific countries: e.g. U.S. chemical industry (Marin and Siotis, 2007); U.S. Pesticide industries (Ollinger and Fernandez-Cornejo, 1998); U.S. supermarkets (Ellickson, 2007); Italian motor insurance industry (Buzzacchi and Valetta, 2006). There are several works that extend empirical tests to a larger set of industries (Robinson and Chiang, 2005), and some that estimate Sutton's theoretical predictions on data from emerging markets (Athreye and Kapur, 2006, Yang and Kuo, 2007).

In his book Sutton tested his model on a set of food industries from several countries. Industries were classified into two groups by the expenditure share of advertising. The results were consistent with the model predictions that homogenous industries have a strongly negative market concentration - market size correlation. The estimated lower bounds for advertising-intensive industries were not horizontal shift of homogeneous industries, as would be the case if advertising costs were considered as additional exogenous sunk costs. The estimated asymptotic values for concentration levels appeared to be much higher for advertising intensive industries than for homogeneous industries.

Robinson and Chiang (1995) tested Sutton's theory on a wider number of consumer and industrial goods industries, measuring R&D and toughness of competition. To that end the authors divided endogenous sunk cost industries into three subclasses: high advertisement + low R&D, low advertisement +high R&D, high advertisement + high R&D. Homogeneous industries were found to converge to concentration levels three times lower than that of advertising-intensive industries. On the other hand, the authors found a non monotonic market concentration - market size relationship in industries with high advertisement level and high R&D share. Battacharya and Bloch (1998) conducted a cross-sectional analysis for a sample of 102 Australian manufacturing industries and found empirical support for Sutton's theoretical prediction that the type of sunk costs determines the relationship between concentration and market size.

There has been limited empirical testing of Sutton's predictions in transition and emerging economies. Testing the theory on transition economies is especially informative. In developed market economies, we observe the industrial structures that have evolved over very long periods of time and that are very stable. In transition economies industrial structures develop from the point that is very far from their "equilibrium" structures. This allows us to verify whether they adjust in the direction predicted by Sutton theory.

Athreye, Kapur (2006) studied the Indian industries structure and adopted a more flexible theoretical approach by assuming that the type of sunk costs influences an equilibrium concentration level, instead of a lower bound. Yang and Kuo (2007) improved market definitions by including exports in Taiwanese industry data. The findings of both studies were in accordance with Sutton's predictions.

The Russian market structure evolution is unique in the sense that during the initial phase of the economic transition in 1991, most industries consisted of separate production entities. By 2003 they had transformed into complex structures with high share of business groups and conglomerates. The major contribution of this chapter is to test Sutton's theoretical predictions against Russian transition economy data, with a consideration for hidden horizontal integration.

Russian plants are relatively large and the degree of establishment concentration therefore relatively high compared with Western standards (Brown and Schaffer, World Bank (2003)). The Russian privatization program, with a few notable exceptions such as Gazprom or the national electricity provider RAO-EES, was initially designed to transfer single establishments into private hands as single-plant firms. As a result, Russian firms were small, compared with Western companies. This generated a peculiar starting point of market structure in Russian industries, namely a market structure with a low degree of firm concentration. This makes the subsequent horizontal integration and mergers process an expected and natural development.

Brown and Brown (2001) studied changes in the industrial structure in Russia during its transition period. They found no strong evidence that significant differences exist in the processes that shape market structure in exogenous and endogenous sunk costs industries. In this chapter we obtain similar results for the year 2003 if the ownership structure of companies is not accounted for. In an additional set of estimations we include this information and conclude to significant differences in the market structure dynamics of industries with exogenous and endogenous sunk costs.

To verify the robustness of our results towards the definition of market bounds we run an additional set of estimations on more disaggregated industries samples. The sensitivity of our results to the number of observations for each type of industry is checked and is shown to be insignificant.

When estimating the lower bound of market concentration ratio, the majority of authors follow Sutton in imposing a strictly positive restriction on the error term and therefore do not account for possible measurement errors. We use a stochastic frontier estimation method and use a composite error term, which better accommodates existing measurement errors in the data.

4.2 Model description

Sutton's (1991) work is widely acclaimed as a very significant contribution to the game-theoretical analysis that was dominating the industrial organization literature at that time, due to his success in overcoming the main weakness of this analytical method, i.e. high dependence of empirical predictions on the model specifications. Before Sutton (1991) many results of game-theoretic models were industry and institution specific at a very detailed low aggregation level. Sutton's model provides theoretical predictions of the market structure dynamics, that are general across a wide set of industries and rely on a small number of easily measurable industry parameters.

These theoretically predicted regularities are falsifiable and can be tested across a wide range of industries. Only two analytical distinctions are required: toughness of price competition and the difference between exogenous and endogenous sunk costs. Toughness of price competition definition stands for the price responsiveness to market structure changes. Both exogenous and endogenous sunk costs are irreversible investments with a considerably high discount on the recovery costs. Exogenous costs are defined exclusively by the current production technology and are taken by the market players as fixed. Sutton uses the costs of building a plant with a minimum efficient scale as a proxy for exogenous sunk costs. Endogenous sunk costs include irreversible investment that are not predetermined by technology but are solely results of the firm's strategic choices. The main example of the endogenous costs is advertising in a broad sense including all costs to build up customer loyalty to the brand. In the industries with easily differentiated products companies use advertising or R&D expenditures to build customer's loyalty, deter entry of new firms.

Sutton motivates the model by two well documented stylized facts. The first one is that ranking of industries by concentration level is similar across countries. The second fact is that negative correlation between concentration and market size breaks down for industries where advertising and R&D play a significant role.

The intuition of the basic framework is straightforward. The relative size of the market, i.e. total size to the minimum efficient scale (m.e.s.) of a factory, determines how many firms operate in a market. The entry of new firms takes place until profits sink to a level such that additional entry by another competitor would not be profitable. An industry with very large sunk costs, e.g., airframe manufacturer, pharmaceuticals, will have a very concentrated market structure with

very few firms operating because they need to generate oligopoly profits to cover their fixed costs. Large markets will tend to have lower concentration because they can generate sufficient profits for a larger number of firms. Fierce competition drives profits down and hence such markets can support a smaller number of firms, i.e., they will be concentrated. The model derivation is provided by Sutton in his 1991 book in Chapter 2.

In his book Sutton presents model derivation for three types of market structure: Cournot, Bertrand and monopoly models. The main assumptions of the model are that the pattern of technology and tastes strongly constrains the equilibrium structure of the industry. Variables expected to have high predicting power are scale economies, advertising intensity, R&D intensity. In the formal model presentation I follow a summary provided by Bresnahan in his review of Sutton's book. His brief version of the original model meets the purposes of this study and allows us to discuss the main assumptions, methods and theoretical predictions to be brought to empirical testing.

A three-equation system determines price, quantity and level of concentration. First equation describes demand: $Q = S * D(P)$, where D(P) is demand per customer and S is the size of the market. On the supply side there is an oligopoly equilibrium condition $P - MC(\frac{Q}{n}) = h(n)$, where n is the number of firms operating in the industry. In equilibrium each of them sells $\frac{Q}{n}$. The firms cost function depends on $\frac{Q}{n}$. The function $h(n)$ describes change in the mark-up with the increase in n. Slope of $h(n)$ is "`the toughness of price competition"'. These two equations determine price and quantity as functions of market size and number of firms, but do not answer the initial question of the endogeneity of n. To get this answer Sutton does not make any assumptions about strategic iteration between companies, he only assumes that prices at least cover costs: $P \geq AC(\frac{Q}{n})$. Inequality in the system does not determine values for n, P and Q. Setting $P = AC(\frac{Q}{n})$ establishes lower bound on concentration as a function of S. This lower bound is a basis of further empirical testing. Under weak conditions on cost and mark-up functions, declining and positive AC and $h(n)$ going down with increase in n, the lower bound in concentration has limit 0 if $S \to \infty$. Comparative static analysis shows that for the industries with higher slope of $h(n)$, "`tougher price competition"', lower bound is higher at any given S.

In the industries where sunk costs σ are exogenous this relationship holds. $AC(\frac{Q}{n},\sigma)$ Depends positively on σ, which will mean lower n in the industry of the same size S and higher σ. In order to make comparisons between the two industries Sutton redefines size of the market as $\frac{S}{\sigma}$.

In *advertising-intensive* industries sunk costs consist of two parts: fixed σ and some additional advertising costs $A(u)$, which are endogenous and enter the equation system in two ways, as part of AC and also part of demand function via impact of $A(u)$ on the consumer preferences, u being the parameter in consumer's utility function.

$$Q = S * D(P,u)$$
$$P - MC(\frac{Q}{n}) = h(n) \qquad (23)$$
$$P \geq AC(\frac{Q}{n},u)$$

Solving the above system as Cournot model with ``perceived quality'' gives two major regularities. The first one is that in the industries with exogenous, determined predominantly by technology sunk costs, market concentration should decrease with the growth of market size. The second regularity is that in the industries with endogenous sunk costs “increases in market size do not lead to an indefinite fall in the level of concentration... and in fact that market concentration market size relationship is not even necessarily monotonic'' (Sutton, 1991, p.60).

4.3 Measuring market concentration in Russian industries

The dataset for this analysis is constructed by merging the Goskomstat (the Russian State Committee for Statistics) annual industrial censuses and the World Bank dataset on Russian companies' ownership. A detailed description of the survey methods and conclusions regarding the ownership dataset can be found in *Chapter 1*.

The Goskomstat data is an economy-wide database covering the entire population of medium and large industrial firms in Russia with annual time series. In order to measure market sizes and shares we use sales information. As was mentioned in *Chapter 2*, Goskomstat data are prone to significant measurement errors and require substantial cleaning. The data cleaning methods employed are detailed in *Chapter 2*.

The definition of market bounds is a very influential parameter in the market structure studies. In the majority of specifications we use the sector definition from the World Bank ownership dataset. As a robustness test we also run estimations on more disaggregated sector sample of Goskomstat own 5-digit industry classification, The World Bank classification differs from the Goskomstat classification in that several 5-digit registry industry codes are merged into a single sector in the former classification and may include other companies based on their actual production activity.

We compute the market concentration as the aggregate share of the four biggest companies in terms of sales (CR_4). We choose this most widely employed indicator to facilitate a comparison of our results with other related studies. The industrial registry data allows us to reliably estimate market shares of companies prior to the wide scale ownership structure change. Note that the Goskomstat data of the late 90s and beginning of 2000s, after the significant M&A activities have taken place, can not be used alone to calculate concentration ratios because it does not contain all the information regarding the horizontal ownership connections between the companies. Consequently we use the Goskomstat data to calculate market shares for the beginning of the privatization process in 1991, when the majority of firms consisted of a single entity.

The World Bank dataset contains information on the ownership of the more than a thousand largest companies among dominant industries in the middle of 2003. We are able to calculate

market concentrations including information on the ultimate owners of companies. Thus, market shares of companies with the same final owner are added together to calculate *CR4* for 2003. In order to separate the ownership effect from the structural changes, we calculate market concentration ratios in 2003 based exclusively on Goskomstat data without accounting for the ownership interrelations.

To calculate the relative market size S/σ we use proxy variables suggested by Sutton (1991). S is the total sales in the industry and σ is the set up costs, which is estimated as the median factory sales in the industry. Connor *et al.* (1985) has shown the insignificant difference between engineering estimate of m.e.s. and median company sales. However when measuring market sizes in Russia, issues arise from the fact that their absolute sizes (real sales) have fallen dramatically during the transformational recession. Indeed if one measures market sizes in 1991 and 2003 using their respective median factory sales, the market size measure may show an increased market size during the transition period even though there was a large fall in sales in real terms. This could happen because the sales of the median firm fall more than total market sales. An additional complication is that the median firm under central planning was a measure of the standard "cookie" size rather than a proxy for minimum efficient scale. We address this issue by using the median 2003 establishment to measure market size in both 2003 and 1991, i.e., we normalize market sales in 1991 and 2003 (in 2003 rubles) by the sales of the median establishment in that market (also in 2003 rubles). The result is a measure of market size that reflects the transformational recession, i.e. market size increases between 1991 and 2003 to a lesser extent.

We separate exogenous and endogenous sunk costs industries by the share of advertising in expenditures following Sutton (1991). Due to a lack of data on advertising expenditures for Russian industries, we use the classification introduced by Brown and Schaffer (World Bank, 2003) and extrapolate the classification of Canadian industries on our sample, assuming a similar response to advertising from Russian consumers.

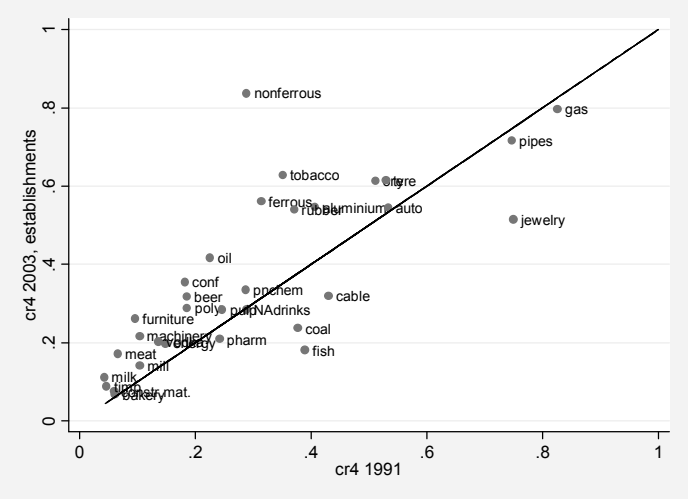
Table 37 contains data on the market concentration in 1991 and 2003, before and after accounting for the ownership structure. It also shows market sizes in 1991 with and without correction for the m.e.s size based on 2003 data. Homogeneous industries are listed first followed by the advertising intensive industries.

Table 37: Market size and market concentration in 1991 and 2003

	1991	1991	1991	2003	2003	2003	2003-1991	2003-1991
	CR4	Market size	Market size cor.	CR4 no ownership	CR4 with ownership	Market size	ΔCR4	ΔMarket Size
Iindustries with homogenous products								
aluminum	0.407	3.636	3.966	0.546	0.955	4.210	0.548	0.244
bakery	0.061	7.817	8.940	0.067	0.067	8.452	0.006	-0.488
cable	0.431	3.334	4.941	0.320	0.320	4.958	-0.111	0.017
coal	0.377	5.626	6.389	0.237	0.532	6.349	0.155	-0.04
constr.mat	0.060	7.068	7.855	0.075	0.170	7.236	0.111	-0.619
energy	0.149	7.982	8.977	0.199	0.648	9.524	0.500	0.547
ferrous	0.314	4.333	5.779	0.561	0.633	6.926	0.319	1.147
gas	0.826	4.962	5.146	0.797	0.933	5.509	0.107	0.363
machinery	0.104	7.164	8.536	0.217	0.262	8.186	0.158	-0.35
nonferrous	0.289	3.655	6.087	0.837	0.904	6.682	0.615	0.595
oil	0.226	4.853	6.850	0.417	0.633	7.747	0.407	0.897
ore	0.512	3.851	4.363	0.614	0.753	4.771	0.241	0.408
pipes	0.747	3.602	4.136	0.717	0.906	4.860	0.159	0.724
pnchem	0.287	3.480	5.268	0.335	0.546	5.490	0.259	0.222
poly	0.186	8.931	9.815	0.288	0.331	10.079	0.144	0.264
pulp	0.247	6.149	7.632	0.285	0.430	7.573	0.183	-0.059
rubber	0.371	3.511	4.785	0.540	0.733	4.972	0.362	0.187
timbre	0.047	7.826	9.712	0.088	0.097	8.653	0.050	-1.059
tyre	0.529	4.063	4.447	0.615	0.792	4.038	0.263	-0.409
Total	*0.325*	*5.360*	*6.507*	*0.408*	*0.560*	*6.643*	*0.236*	0.136
Industries with intensive advertising								
auto	0.534	6.213	7.855	0.545	0.745	7.998	0.211	0.143
beverages	0.288	4.884	5.254	0.284	0.413	6.668	0.125	1.414
beer	0.186	6.269	6.067	0.317	0.506	7.330	0.320	1.263
conf	0.182	6.911	7.334	0.355	0.498	7.551	0.316	0.217
fish	0.389	6.888	8.078	0.181	0.223	7.257	-0.166	-0.821
furniture	0.096	6.952	8.864	0.261	0.261	7.435	0.165	-1.429
jewelry	0.750	4.717	6.716	0.515	0.610	6.036	-0.140	-0.68
meat	0.066	6.866	9.167	0.172	0.289	7.826	0.223	-1.341
milk	0.043	7.837	8.938	0.112	0.187	8.385	0.144	-0.553
mill	0.105	5.565	8.281	0.141	0.177	7.348	0.073	-0.933
pharm.	0.242	5.415	6.403	0.209	0.386	5.910	0.144	-0.493
tobacco	0.352	3.387	4.472	0.628	0.797	5.811	0.445	1.339
vodka	0.136	5.536	6.561	0.202	0.263	6.808	0.126	0.247
Total	*0.259*	*5.957*	*7.230*	*0.302*	*0.412*	*7.105*	*0.153*	-0.125

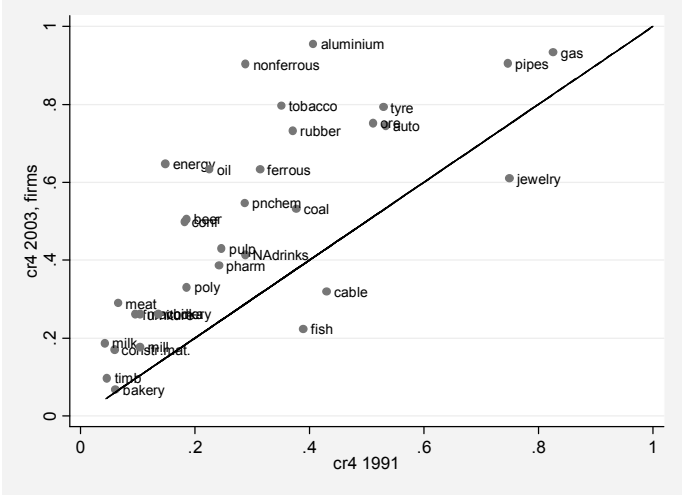
The changes in market structure reflected in Table 37 are better represented by the following diagrams. Figure 4 shows the variations in market concentration, measured as CR4 from 1991 to 2003, before taking into account ownership information, i.e. different companies may have the same owner. Only in 7 industries out of 32 have the concentration decreased, with the highest amplitude changes experienced in coal, cable, jewellery and fish industries that in Soviet period had factories far exceeding the corresponding m.e.s. In the majority of markets concentration has increased, with tobacco, beer, oil and metallurgy sectors being among the leaders of concentration growth.

Figure 4: Market concentration (CR4) in 1991 and 2003
(before accounting for ownership structure)



After accounting for changes in the ownership structure it is clear that market concentration in 2003 is higher than in 1991 in all but three industries. This is illustrated in Figure 5 where many industries went through wide scale consolidation processes. Concentration ratios in aluminum, energy and metallurgy industries have changed the most, by up to 20 percentage points in CR_4 after taking into account information on the ownership structures. This might be explained by the fact that these industries are dominated by business groups, which were responsible for the largest share of horizontal integration of companies. Two waves of mergers and acquisitions have driven much of Russia's recent enterprise restructuring and market consolidation.

Figure 5: Market concentration (CR4) in 1991 and 2003
(after accounting for the impact of ownership structure)



The relationship between industries concentration levels and their sizes in 1991 is shaped by the laws of the Soviet economic system. The standardization, i.e. the "cookie-cutter" approach, convenient from the central planner's point of view, was widely used for the purposes of industrial development. It was common that the central planning agency would choose a fixed size for a factory in a particular industrial activity, and then build several other replicas. As the turnover for this particular output increased in size, the planners would construct more factories. The widespread cross-subsidizing, low transport and energy tariffs and other existing biases in the pricing mechanism of this planned economy prevented the standard plant scale to be equivalent to the minimum efficient scale. The correction of the market size measurement in 1991 is predominantly on the upper side due to the fact that a median size Soviet factory was larger than the m.e.s. plant, defined as the median size plant in 2003. Since Russia was essentially a closed economy, firms did not face direct competition with from imports. Taken to the extreme, the central planner's approach to designing the industrial structure would mean that the market concentration- market size relationship would fit the $CR_4 = 4/n$ curve, where *n* is the number of companies.

Although real 1991 data do not precisely fit the above equation, the concentration ratios in 1991 are very close to the benchmark line, especially if compared to the market structure graph in 2003. The observed negative relationship of the concentration level and the market size is not a result of strategic interaction of companies and market forces but rather an optimal solution to the central planner's task. In 2003 concentration levels have gone up in most industries and market sizes have recovered from the substantial fall during transition years. Although the negative trend of CR_4 with market size can still be observed in the scatter plots, the gap in concentration levels of industries with similar market sizes has substantially widened. Note that for any particular market size the variance of CR_4 increases in 2003 compared to that of 1991.

Figure 6: Change in market concentration from 1991 to 2003,
and accounted for the ownership structure

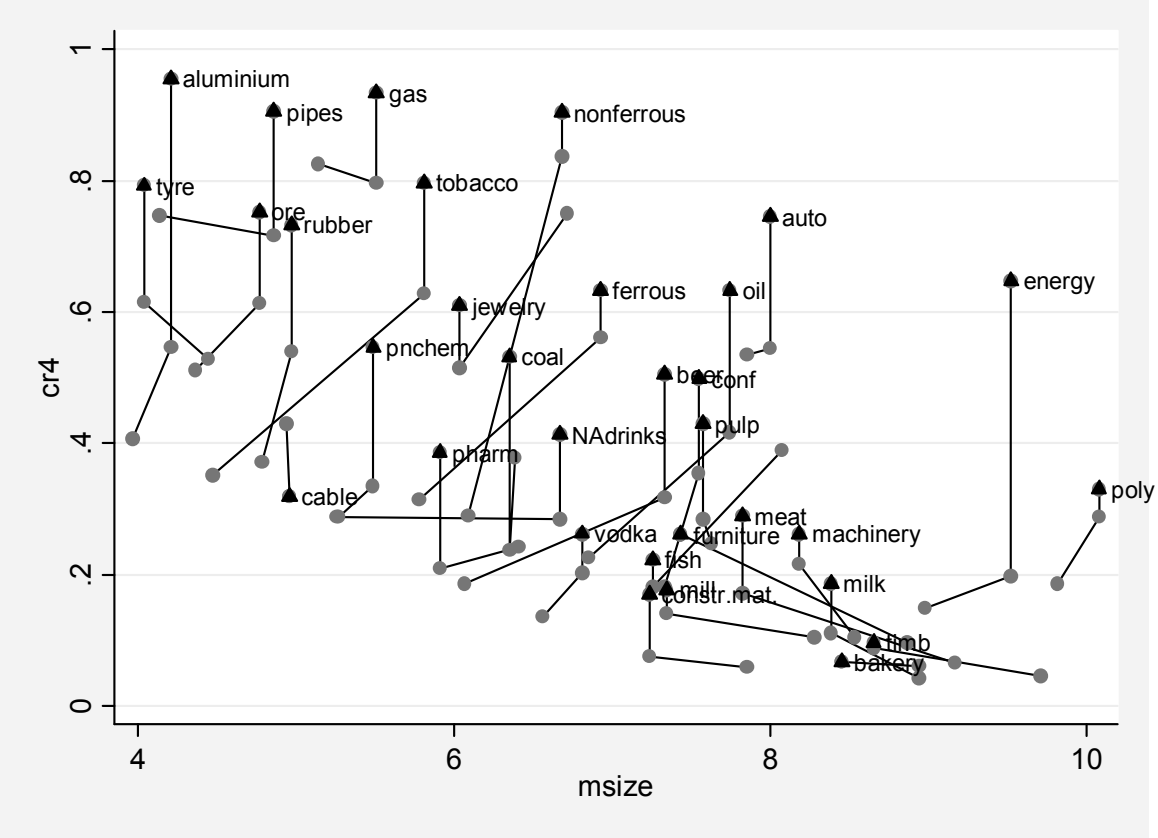


Figure 6 depicts the dynamics of market structure changes in Russian industries between 1991 and 2003. The graph is constructed so that each oriented line, corresponding to a different industry, comprises three data points. The first and second data points represent the levels of concentration and market size in 1991 and 2003 respectively, without accounting for ownership information. The final point, indicated by the position of the arrow, reflects the correction in concentration level due to ownership connections. Figure 7 and Figure 8 are constructed in a similar manner and illustrate market structure changes for homogeneous and intensive-advertising industries respectively.

Figure 7: Market concentration change in the homogeneous industries

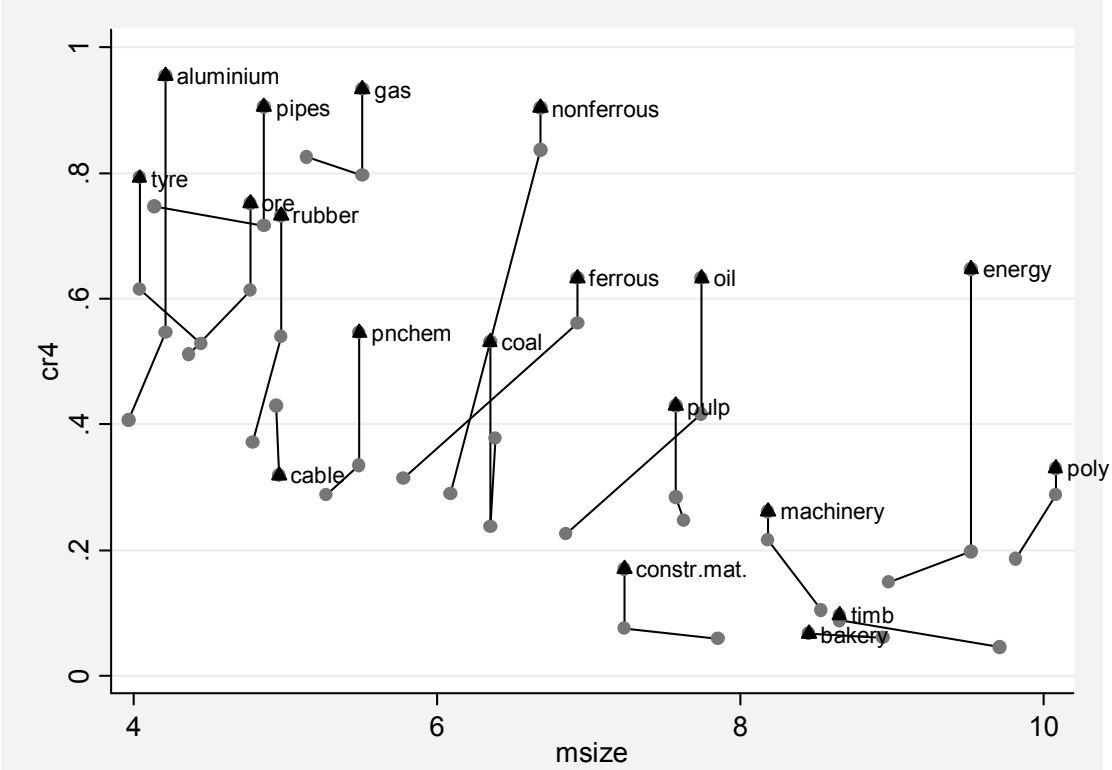
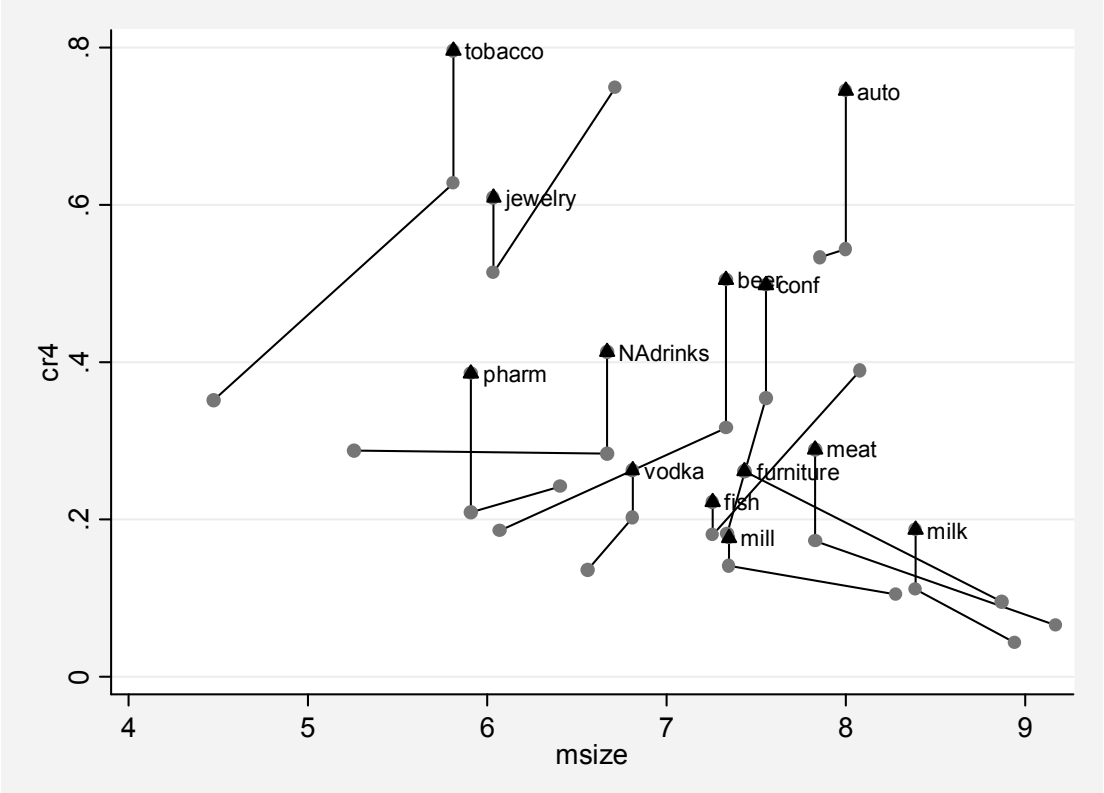


Figure 8: Market concentration change in industries with intensive advertising



With the exception of energy and chemical sectors, homogenous industries exhibit a strong negative correlation between concentration level and industry size. There are many homogeneous industries clustered at the high end of the bound – these are industries with high m.e.s., such as metallurgy, oil, gas and ore. These industries have a large export component and should, in theory, be analyzed in more global or at least regional context. This correction would both increase the market size and lower the concentration ratios of these industries.

Intensive advertising industries demonstrate an even higher divergence between the market structures in 1991 and 2003. Particularly high variations in concentration ratios can be observed at the low end of the market structure bound. This is in good agreement with theoretical predictions. In the next section we use stochastic frontier method to estimate the data trends and relationships outlined above.

4.4 Lower bound for market concentration

In this section we seek to assess the market concentration - market size relationship. Following Sutton (1991) we model the market concentration as the hyperbolic function $\ln CR_4 = \alpha + \beta / \ln msize + u$, where CR_4 is the market concentration defined as the market share of the four largest firms in the industry, *msize* is the market size proxy calculated as the ratio of the total sales in the industry to the median firm sales, α is a threshold to which market structure converges when the market size goes to infinity, β is a reverse elasticity of concentration level to market size changes and *u* is a composite error term.

Many empirical studies testing the validity of Sutton's predictions assume a non-negative distribution of the error term, e.g. a normal distribution defined for positive variables only. We will refer to this distribution as the positive distribution. However, we believe that this condition on the error term may exaggerate the impact of outliers and possible measurement errors on the results. Since the transition company level data is highly prone to measurement errors we find it more practical to define the composite error term u_i such that $u_i = v_i + \varepsilon_i$, where v_i has a positive distribution and ε_i is a normally distributed standard error term. This second term adds flexibility to our estimation and incorporates possible measurement errors in the industry concentration ratios that may be negative.

The bound for market concentration is estimated with the maximum likelihood method with the help of the *frontier* procedure implemented in the econometric software *Stata*, which enables us to account for the two error terms v_i and ε_i previously described. Estimations with different functional forms of the lower bound equation produced similar results. Therefore we only report the results obtained with the hyperbolic equation detailed above.

Sunk costs theory of market structure predicts a different relationship between concentration level and market size for industries with exogenous sunk costs, i.e. homogeneous industries, and industries with endogenous sunk costs, i.e. industries with intensive advertising or high R&D expenditures. The market concentration in homogeneous industries should decline with the expansion of the relative market size. On the other hand, for intensive advertising industries this relationship does not have to hold or be monotonic. We test these predictions

on Russian industry data in 1991 and 2003, with and without ownership structure correction in market concentration ratios. To that end we use a modified model defined as:

$$\ln CR_4 = \alpha_1 + \alpha_2 * ad + \frac{\beta_1}{\ln msize} * (1 - ad) + \frac{\beta_2}{\ln msize} * ad + v + \varepsilon, \quad (24)$$

where *ad* is the dummy variable for industries with intensive advertising. This model allows different levels and slopes of the lower bound for two types of industry. Theoretical predictions indicate a positive and statistically significant β_1 coefficient (as the equation includes the inverse market size measure it will signify negative relationship between the parameters) and a statistically insignificant β_2 coefficient in 2003, after the market forces and strategic firm's behaviour had shaped the market structure. In 1991 we expect both coefficients to be significant and positive due to the specificity of the central planner's approach to the industrial structure formation.

Theoretical implications for concentration lower bound do not suggest constant and independent error term. One consequence of the fact that the market concentration does not converge to zero when the market size is going to infinity could be positive relationship between variance and market size. Allowing for correlation between the positive error component variance (σ2ν) and the explanatory variable (1/lnmsize) is standard for frontier estimations; however, this implication is usually not tested in the lower bound literature. We account for this possibility by imposing the heteroskedastic structure on the non-negative error component. According to the economic priors available to us, the positive error term can be correlated with the market size and type of industry. We estimate four specifications of the error term structure:

1) $\sigma_v^2 = const$

2) $\sigma_v^2 = \gamma_1 + \gamma_2 ad + \gamma_3 \ln msize * ad + \gamma_4 msize(1 - ad)$

3) $\sigma_v^2 = \gamma_1 + \gamma_3 \ln msize * ad + \gamma_4 msize(1 - ad)$

4) $\sigma_v^2 = \gamma_1 + \gamma_2 ad$

4.4.1 Lower bound estimation: 32 industries

Table 38 contains the estimation results of the lower bound for market concentration in 32 sectors, defined in the World Bank ownership database for 1991.

Table 38: Lower bound estimation for market concentration in 1991

	1991	1991	1991	1991
ad	-0.416***	-0.416***	-0.416***	-0.416***
	(0.00016)	(0.000098)	(0.00015)	(0.000055)
1/msize *ad	22.32***	22.32***	22.32***	22.32***
	(0.00081)	(0.00051)	(0.00083)	(0.00032)
1/msize*(1-ad)	19.08***	19.08***	19.08***	19.08***
	(0.00058)	(0.00033)	(0.00049)	(0.00017)
Const	-5.187***	-5.187***	-5.187***	-5.187***
	(0.00013)	(0.000071)	(0.00011)	(0.000040)
$\ln \sigma_{\varepsilon}^2$	-33.58	-32.37	-32.38	-32.92
	(574)	(193)	(291)	(132)
$\ln \sigma_{v}^2$				
ad		-2.689		0.348
		(4.22)		(0.51)
msize *ad		0.346	0.00940	
		(0.56)	(0.16)	
msize*(1-ad)		-0.0793	-0.0500	
		(0.17)	(0.17)	
Const	0.634**	0.983	0.778	0.477
	(0.25)	(1.18)	(1.13)	(0.32)
Test of coeff. equal.	>100	>100	>100	>100
$chi^2(1)$	0.00	0.00	0.00	0.00
Loglikelihood	-33.36	-32.83	-33.03	-33.98
Obs	32	32	32	32

Note: σ_{ε}^2 is a variance of normally distributed error term and σ_{v}^2 is variance of positively distributed error term

These results are consistent with theoretical predictions, namely that the inverse relationship between concentration level and market size is significant for both types of industries. The statistical test for the exact equality of the slope coefficients in the lower bound equations is rejected; however the difference between the coefficients is small in absolute terms. It is worth noting that at the starting point of market transformations, endogenous sunk costs industries had a lower level of concentration. There is no evidence that the variance of the positive error component changes with market size, which is in line with the economic intuition on the structure of industry in planned economy.

Table 39: Lower bound estimation for market concentration in 2003 before taking into account ownership structure

	2003	2003	2003	2003
ad	2.409***	2.409***	2.409***	2.409***
	(0.0027)	(0.00043)	(0.00029)	(0.00047)
1/msize *ad	14.89***	14.89***	14.89***	14.89***
	(0.018)	(0.0024)	(0.0016)	(0.0015)
1/msize*(1-ad)	27.12***	27.12***	27.12***	27.12***

	(0.0028)	(0.0016)	(0.0010)	(0.0028)
Const	-6.258***	-6.258***	-6.258***	-6.258***
	(0.00040)	(0.00030)	(0.00019)	(0.00041)
$\ln \sigma_{\varepsilon}^2$	-31.55	-30.53	-32.51	-31.93
	(374)	(220)	(392)	(264)
$\ln \sigma_{\nu}^2$				
ad		1.757		-1.024**
		(3.50)		(0.51)
msize *ad		-0.0999	0.0901	
		(0.43)	(0.21)	
msize*(1-ad)		0.299	0.242	
		(0.24)	(0.21)	
const	0.814***	-0.960	-0.560	1.116***
	(0.25)	(1.63)	(1.42)	(0.32)
loglikelihood	-36.26	-33.54	-33.67	-34.42
obs	32	32	32	32

Note: σ_{ε}^2 is a variance of normally distributed error term and σ_{ν}^2 is variance of positively distributed error term

Table 40: Lower bound estimation for market concentration in 2003 after accounting for ownership structure of firms

	2003	2003	2003	2003
ad	0.0276	1.037	1.506	1.230
	(3.00)	(3.10)	(2.86)	(2.61)
1/msize *ad	21.62	20.73	21.13	21.62
	(19.8)	(16.8)	(17.1)	(15.7)
1/msize*(1-ad)	24.92***	22.91*	26.78***	24.77***
	(7.22)	(12.5)	(8.53)	(7.85)
const	-3.499	-4.357**	-4.869***	-4.647***
	(17.6)	(2.09)	(1.67)	(1.34)
$\ln \sigma_{\varepsilon}^2$	0.224	-0.234	-0.192	-0.238
	(0.94)	(0.47)	(0.48)	(0.45)
$\ln \sigma_{\nu}^2$				
ad				-12.01
				(282)
msize *ad		-1.127	-1.078	
		(2.65)	(4.74)	
msize*(1-ad)		-0.0862	0.0976	
		(0.45)	(0.15)	
const	-5.288	1.410		0.828
	(619)	(3.00)		(0.96)
loglikelihood	-49.02	-48.12	-48.23	-48.15
obs	32	32	32	32

Note: σ_{ε}^2 is a variance of normally distributed error term and σ_{ν}^2 is variance of positively distributed error term

Table 39 and Table 40 contain results of the lower bound estimation for market concentration level in 2003, before and after accounting for the ownership structure. Without accounting for

this information, i.e. ignoring the de-facto horizontal integration of some companies, our estimations do not show any significant differences between the two types of industries. The coefficients for the inverse market size in both equations are positive and significant. However, the lower bound for homogeneous industries decreases and has a sharper slope compared with advertising intensive industries. At the same time the floor for market concentration is higher for advertising intensive industries. The relationship between variance of the positive error component and market size and type of industry is insignificant and thus going forward we assume it to be constant.

Including ownership information in the calculus of concentration levels substantially modifies the previous results. Indeed, the slope coefficient becomes insignificant. This means the lower market concentration bound for intensive advertising industries appears to be independent of the market size. The concentration ratio in homogenous industries consistently exhibits a negative correlation with the market size. These results are in good agreement with Sutton's theory of market structure and provide additional evidence that the market forces and strategic interaction between firms are shaping the industrial landscape in one of the transition economies. The predicted lower bounds for industries with exogenous and endogenous sunk costs are depicted in Figure 9 and Figure 10 with continuous and dotted lines respectively.

Figure 9: Lower bound for market concentration in 1991 by the type of industry

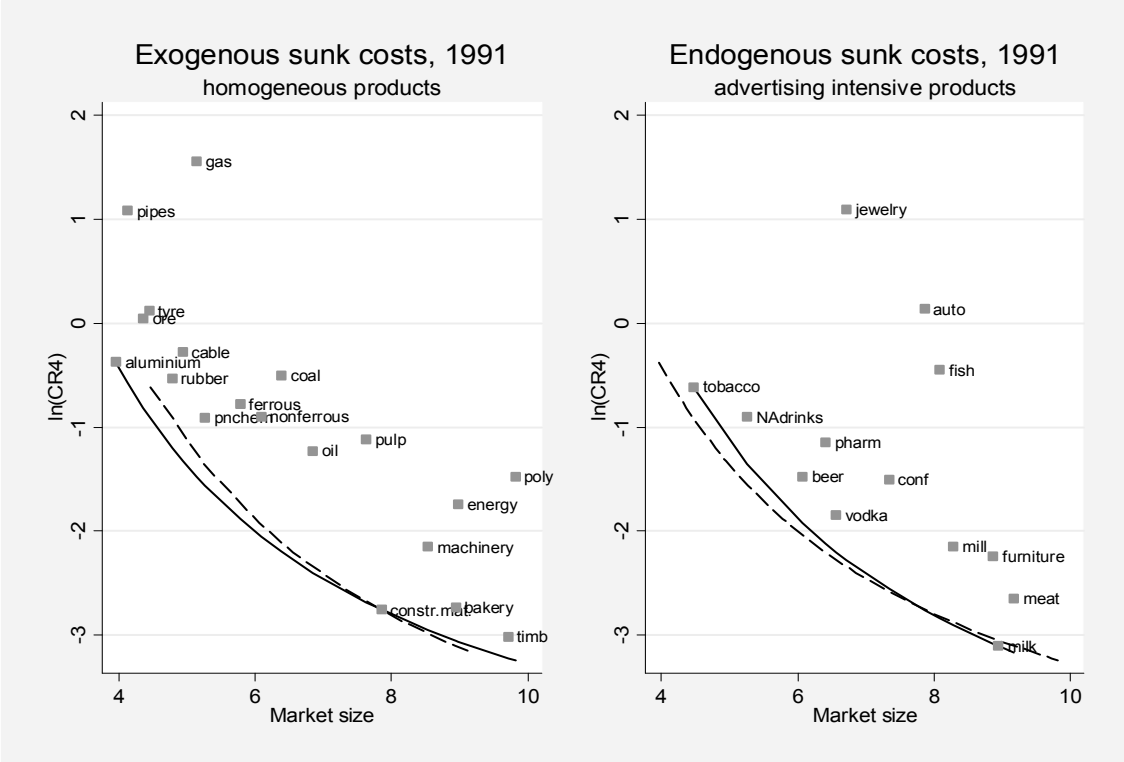
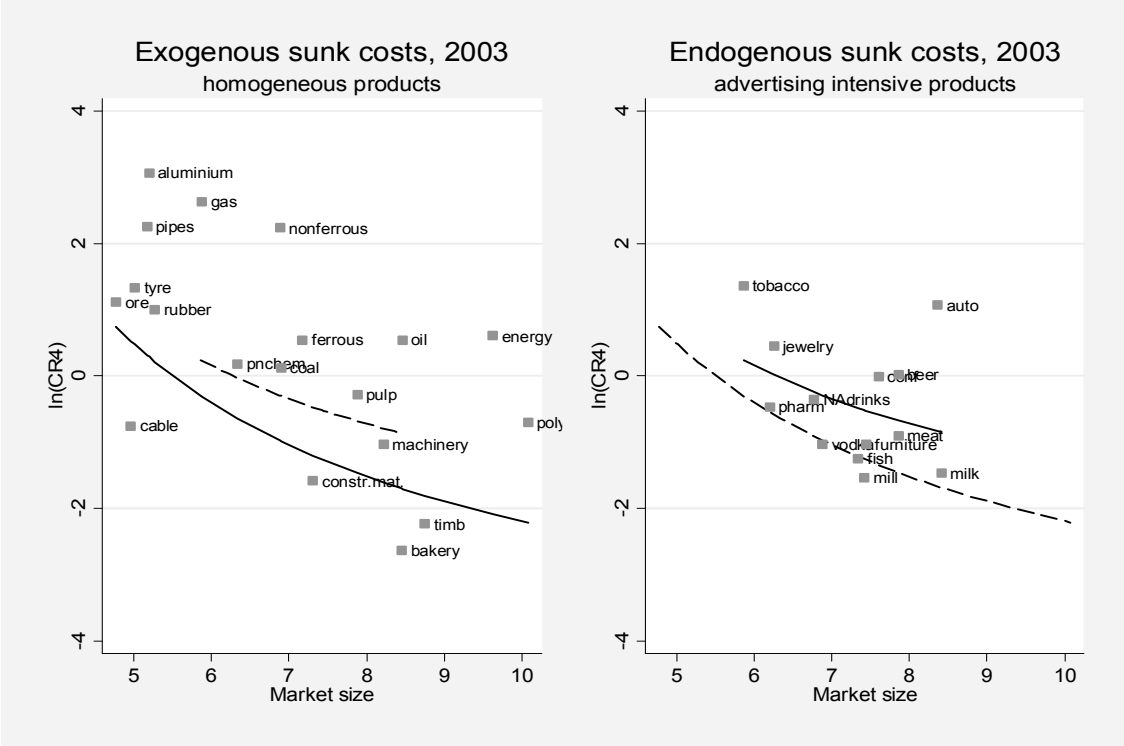


Figure 10: Lower bound for market concentration in 2003
after accounting for ownership structure of firms by the type of industry



The above estimations were based on the industry classification defined in the World Bank ownership database (Chapter 2 CEM World Bank (2003). The definition of market size and its relationship to industry classification is a separate topic of research on its own and requires complicated estimations of the cross-product elasticities of substitution. These estimations are beyond the scope of this dissertation. However, to strengthen the validity of our results we test their sensitivity to different industry classifications. We conduct the robustness check by estimating our equations on the set of more disaggregated sectors.

4.4.2 Lower bound estimation: 60 industries

Table 41 contains statistics for the 60 industries sample classified by the 5-digit codes used in the Russian industrial registry. These 60 industries make up 32 aggregated sectors that were analyzed above. We recalculate market sizes and concentration levels based on the new market bounds definitions. The type of each industry is defined by the type of the aggregated sector it belongs to.

Table 41: Sample statistics for 60 industries

		1991		2003	
		CR4	ln(S/sigma)	CR4	ln(S/sigma)
homogeneous	mean	0.559	5.54	.628	5.19
N=45	median	0.592	5.42	.642	4.89
with intensive advertising	mean	0.321	7.03	.421	6.76
N=15	median	0.294	6.72	.372	6.96

For the sample of disaggregated industries, market concentration also increased between 1991 and 2003 in the majority of cases for both exogenous and endogenous sunk costs industries. After the significant decline in the middle 90s, market size has recovered in many industries. Table 42 contains results of the lower bound estimations for 60 disaggregated industries in 1991 and 2003 with and without accounting for the ownership consolidation. As in the 32 sectors case there is no strong evidence supporting the positive error term heteroscedasticity and allowing for this error term structure does not change our results significantly. For these reasons we do not report these results.

Table 42: Lower bound estimation for market concentration for more disaggregated sectors

	1991	2003 before	2003 with ownership
ad	-1.940*	0.424***	0.312
	(1.16)	(0.0011)	(1.64)
1/msize *ad	18.35**	14.31***	12.95
	(7.26)	(0.0076)	(10.7)
1/msize*(1-ad)	9.525***	11.55***	13.22***
	(1.78)	(0.00014)	(1.20)
const	-3.101***	-4.176***	-3.735***
	(0.44)	(0.000066)	(0.36)
$\ln \sigma_{\varepsilon}^2$	-0.896*	-31.21	-2.369**
	(0.50)	(151)	(0.99)
$\ln \sigma_{\nu}^2$	0.587	1.420***	1.484***
	(0.43)	(0.18)	(0.23)
loglikelihood	-81.42	-89.02	-98.04
obs	60	60	60

Note: σ_{ε}^2 is a variance of normally distributed error term and σ_{ν}^2 is variance of positively distributed error term

The estimations market concentration – market size relationship for a set of more disaggregated industries are consistent with previous conclusions. Homogeneous industries have a lower market concentration bound that is decreasing with the market size. This relationship does not hold for intensive advertising industries.

4.4.3 Testing the effect of industry sample

The above findings for both industry samples are consistent with Sutton's theoretical predictions: there is a significant negative relationship between market size and market structure for both industry types in 19 and 45 industries from the aggregated and disaggregated sectors respectively. However, both samples have a larger number of observations for homogeneous industries than for advertisement intensive industries.

In our first set of regressions we have 19 observations for homogeneous industries and 13 for advertisement intensive sectors. In the second set of regressions the number of industries of a second type increases slightly. However, the imbalance increases with the samples size.

In order to assess whether the concentration's lower bound independence of the market size in 2003 is driven by the imbalance in the number of observations, we run the estimations on an equal number of observations for both types of industries. As a robustness check we estimate regressions for every possible combination of 13 industries out of 19, where the total number of simulations is $C_{nk} = n!/k!(n-k)!$ and equals 17136. Table 43 contains the summary results of these simulations.

Table 43: Testing sensitivity of our results to the sample composition

Null hypothesis	F(beta=0)<0.05
b[1/msize_ad]=0	71
b[1/msize_no]=0	16319
Total number of regressions	17136

The lower bound coefficient for homogeneous industries is significant in 95% of regressions. For advertising intensive industries it is insignificant in 99.6% of regressions. The above simulations show that our results are robust to sample changes and are not driven by the smaller number of observations in the case of intensive advertising industries.

4.4.4 Lower bound estimation: time shift

In this section we test the time shift in the lower market concentration bound for both types of industries. In the first set of regressions we look at the 1991 and 2003 data before taking into account the ownership structure. In the second set we estimate the total shift in market structure from 1991 to 2003 corrected for horizontal integration. Table 44 reports results separately for homogeneous and advertising-intensive industries.

Table 44: Estimating the lower bound for market concentration change from 1991 to 2003 by the type of industry

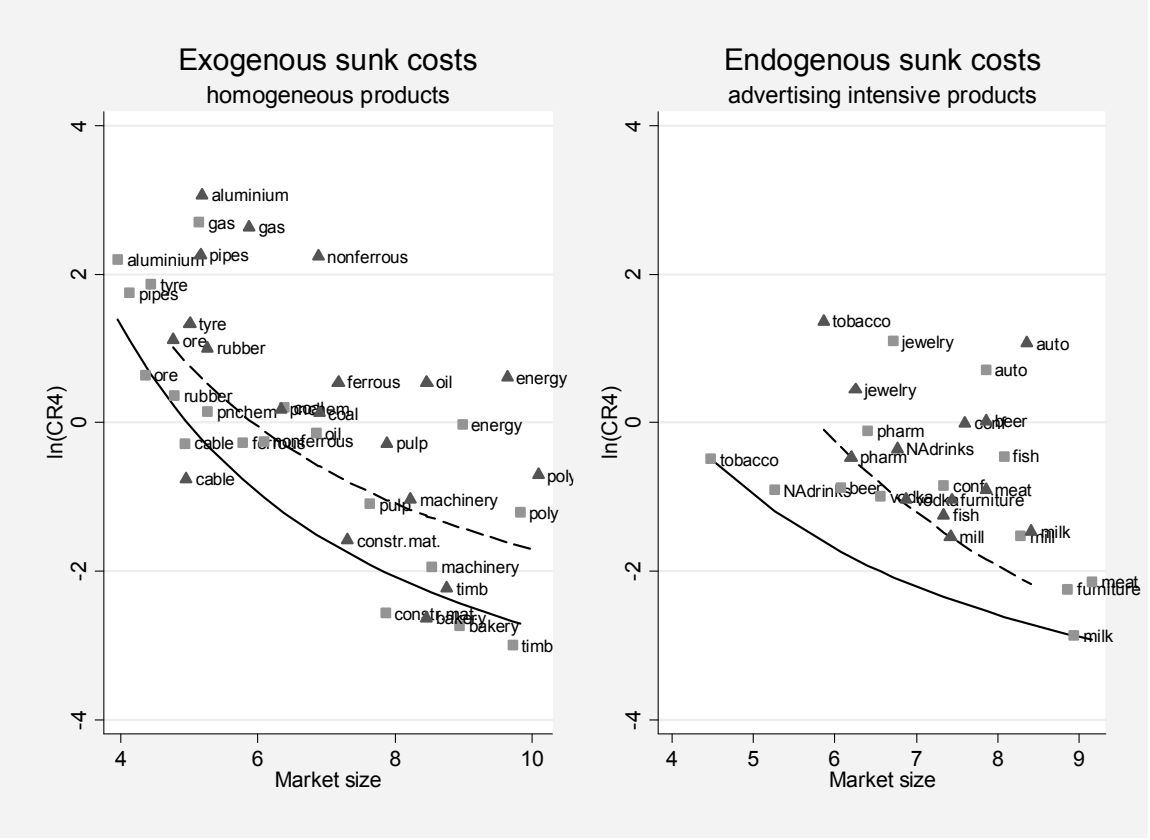
	Homogeneous industries		With intensive advertising	
	1991, 2003 entities level	1991, 2003 with ownership	1991, 2003 entities level	1991, 2003 with ownership
T=1 for 2003, 0 for 1991	-1.071***	0.802	1.753***	-1.354
	(0.00013)	(1.34)	(0.00036)	(3.19)
1/msize 2003	27.12***	24.92***	14.89***	40.23*
	(0.00071)	(6.66)	(0.0024)	(23.7)
1/msize 1991	19.08***	19.75***	22.32***	22.32***
	(0.00039)	(4.88)	(0.00082)	(0.0023)
const	-5.187***	-4.249	-5.602***	-5.602***
	(0.000084)	(34.4)	(0.00017)	(0.00040)
$\ln \sigma_{\varepsilon}^2$	-31.37	0.0639	-32.17	-29.40
	(120)	(0.29)	(392)	(231)
$\ln \sigma_{\nu}^2$	0.847***	-10.29	0.524*	0.682**
	(0.23)	(14755)	(0.28)	(0.28)
time shift Chi2 test	>100	0.392	>100	0.571
p-value	0	0.531	0	0.450
loglikelihood	-43.67	-55.13	-25.69	-27.74
obs	38	38	26	26

Note: σ_{ε}^2 is a variance of normally distributed error term and σ_{ν}^2 is variance of positively distributed error term

This model specification strengthens the validity of our previous results. For industries with exogenous sunk costs the concentration ratio is always negatively related to the market size and this trend is amplified in 2003. The lower bound level is significantly lower in 2003 than 1991 before we apply the ownership structure. This can be explained by the high entity level concentration in the Soviet economy, and which has decreased after its collapse. However once we move back to the company level (by accounting for the ownership structure) this difference becomes insignificant.

Market concentration in advertising intensive industries seems responsive to changes in the market size in 2003 before ownership structure adjustment in the data, but to a lesser degree than in 1991. Its significance declines sharply once the concentration numbers include hidden horizontal integration. The predicted lower bounds for years 1991 and 2003 are depicted on Figure 11 as continuous and dotted lines respectively.

Figure 11: Lower bound shift from 1991 to 2003 by the type of industry



4.5 Conclusion

The Russian economy went through a wide-scale transformation during the last decade. This chapter has focused on the evolution of its market structure. Our empirical analysis is based on the theoretical developments by Sutton (1991) on cross-industry determinants of market structure. Merging government census data on firms and individual establishments with the World Bank ownership database makes it possible, in effect, to reconstruct multi-plant firms and conglomerates and consequently calculate market concentration level better reflecting economic realities. Contrary to standard estimation methods employed in the literature, the method we apply allows us to take account of measurement errors. This is important considering the high noise content in Russian statistical data.

Our results confirm Sutton's theoretical predictions. In 1991, before the economic transition, both exogenous and endogenous sunk costs industries had a market concentration lower bound that was inversely related to the market size. In 2003, however, significant differences appear between both types of industries when ownership structure information is accounted for. Thus the market concentration ratios become independent of the market size for industries with intensive advertising.

We conduct additional robustness checks by 1) replicating the estimations on disaggregated industries; 2) by considering an equal number of observations for two types of industries and varying the matching observations mix of homogenous industries. Both procedures lead to conclusions that are in agreement with our initial findings.

These results are in line with Sutton's theory of market structure formation and provide additional evidence that the market forces and strategic interaction between firms are shaping the industrial landscape in Russia.

Chapter 5: Conclusion

This thesis starts by exploring ownership and control structures based on a set of large Russian companies. We learn that the main stakeholder can exercise control level higher than his ownership stake via several methods: by creating pyramidal structures which is commonly accounted for in the literature, by using affiliated management or by controlling supply and delivery networks or debt arrears. We estimate and decompose the total control-ownership gap into two components: pyramidal and informal. This chapter contributes to the existing literature in two ways: 1) by revealing the significance of the widely omitted non-pyramidal component of the control-ownership gap; 2) by expanding our knowledge of the ownership and control structures of Russian corporations.

Russian companies have a high concentration of ownership by international standards. The control-ownership gap is among the highest in the world once we account for its full size. Less than a half of the control-ownership gap comes from pyramidal structures, the rest is exercised via less formal channels of control. We not only find that the size of the omitted control–ownership gap is substantial compared to the pyramidal gap, but also that it varies with the type of owner. The high correlation of omitted variables with some explanatory variables leads to biased estimators. We acknowledge that great care must be employed when extrapolating our results to other countries. Nevertheless these results strongly indicate that studies on the impact of control-ownership gap on the performance of companies may be biased when omitting the non-pyramidal component.

We find that control-ownership patterns differ substantially according to the type of institutional owner: business groups have the highest control-ownership leverage with 60 % of it coming from less formal methods. Foreign owners are on the opposite end of the control-ownership gap scale. It is worth noting that federal and regional governments differ in a way they control their companies: federal government is more likely to use pyramidal structures while regional governments often employ other methods of control-ownership leverage.

In the third chapter we studied the influence of business groups and other institutional owners on the performance of companies. Large sample quantitative studies on business groups in transition economies remain scarce and this chapter contributes to expanding our knowledge in this field. In addition we use several additional estimation techniques to address the known

problems in the literature. We find that companies owned by business groups tend to have lower productivity levels. We employ several methods to check the robustness of this result: 1) looking at the additional time periods separately as well as applying panel-data methods; 2) examining alternative production function forms; 3) introducing instrumental variables to address the endogeneity problem. These estimations confirm the business groups' adverse impact on companies' performance.

Consequently, we study the productivity growth factors. Our work builds on the results of Guriev and Rachinsky (2005), and we advance their analysis in several directions: 1) by supplementing the one-year cross-section with additional time periods; 2) by using long-difference estimation method in order to minimise the impact of measurement errors; 3) by testing different levels of fixed elasticity of output to capital. The majority of our estimation results do not show any statistically significant role of business group ownership in the firms' productivity growth. The introduction of the control-ownership measure, as calculated in chapter 2, as an explanatory variable in productivity equations, can be an interesting extension of this research. This could be used to address the question whether the control-ownership gap has a direct impact on companies' performance or this impact is owner specific.

Chapter four focuses on the evolution of the market structure. Information on ownership and control structures allows calculating realistic concentration ratios in Russian industries. The unique starting point of the market structure changes makes it possible to test the theory of market structure formation by Sutton (1991) without dealing with the endogeneity problems. The empirical literature studying the validity of Sutton's predictions is not abundant and is often focused on specific industries in advanced countries. The main contributions of this chapter are 1) testing the theory of market evolution in the largest transition economy; 2) accounting for hidden horizontal integration by using information on ownership; 3) applying a different estimation method that accounts for the existence of measurement errors.

Finally our results provide additional supporting evidence that the evolution of markets in the Russian economy is influenced by the laws and regularities formulated by Sutton for advanced economies. However, this result holds only after accounting for the information on the ownership of companies. We show that in 2003 after accounting for hidden horizontal integration in exogenous sunk costs industries, the concentration level decreases with the market size growth. On the other hand the market concentration in the endogenous sunk costs

industries does not depend on the market size. In 1991 before the economic transition, both types of industries resembled a similar pattern of market structure defined by the central planning agency. Similar estimations on the set of disaggregated industries confirm these results which are robust to the sensitivity check of the differences in the number of observations for those two industries.

The World Bank dataset of the ownership structure of large Russian companies allowed us to study several interesting aspects of the development of one of the largest transition markets, namely measuring the gap between control and ownership within the firms, estimating the impact of different types of owners on the productivity of their companies and studying the true market structure evolution. However, some of our estimations were limited by the fact that available ownership information included only one cross-section set of observations. In the future, the availability of ownership data for different points in time would allow to address a wider set of questions. The research results presented in this thesis could then serve as a benchmark for studying the process of ownership change. In addition estimating the same models on the extended dataset would be an interesting check of the robustness of our results.

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Appendix

Table 1: World Bank survey sector and sample coverage

	Total economy	Covered (sub)sectors		Surveyed firms		
			% of total (2)/(1)		% of covered (sub)sectors (4)/(2)	% of total (4)/(1)
	(1)	(2)	(3)	(4)	(5)	(6)
By employment (persons):						
Total in economy	64,400,051					
Industry	16,467,915	8,262,857	50.2	2,787,218	33.7	16.9
Construction	3,928,709	2,009,805	51.2	71,341	3.5	1.8
Trans/Communic/Media	5,899,027	1,360,813	23.1	419,368	30.8	7.1
Trade	8,628,161	2,307,782	26.7	24,802	1.1	0.3
All	34,923,812	13,941,257	39.9	3,302,729	23.7	9.5
By sales (mln Rub):						
Industry	5,881,000	4,499,909	76.5	3,373,954	75.0	57.4
By assets (mln Rub):						
Banking	3,399,214	3,399,214	100.0	2,321,604	68.3	68.3

Table 9b: Determinants of the control-ownership gap existence: probit estimation, marginal effects.

	Pyramidal effect $\lambda > 0$	**Control effect** $\kappa > 0$	**Total** $\gamma > 0$
Business groups	0.230**	0.094*	0.118**
	(0.048)	(0.046)	(0.024)
Foreigners	-0.368**	-0.212*	-0.311**
	(0.085)	(0.085)	(0.091)
Federal government	0.084	-0.301**	-0.128
	(0.080)	(0.081)	(0.067)
Regional government	-0.046	-0.100	-0.178*
	(0.086)	(0.081)	(0.079)
Size (log sales)	-0.079**	-0.027	-0.031**
	(0.017)	(0.015)	(0.011)
Capital/Sales	-0.022	0.004	0.002
	(0.018)	(0.016)	(0.010)
Sales/Labor	0.020	-0.009	0.015
	(0.026)	(0.023)	(0.016)
Industry dummies	+	+	+

Standard errors in parentheses * significant at 5%; ** significant at 1%